THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

Vol. 24 NEW YORK, NOVEMBER, 1926 No. 11

# The Application of Technical Control to the Metal Rolling Mill

## How the Scovill Manufacturing Company Uses the Laboratory to Control the Plant.* Part 1.

By WILLIAM B. PRICE

Chief Chemist and Metallurgist, Scovill Manufacturing Company, Waterbury, Conn.

At the present time it is generally understood that technical control as applied to the modern brass mill or manufacturing concern, especially in the examination of pure metals and alloys, include

A—Physical Testing.
B—Chemical Analysis.
C—Microscopic examination of polished and etched sections.
D—Pyrometric control of heat treatment.
E—Metallography.

I shall outline and explain technical control as used in the plant of the Scovill Manufacturing Company, and devote most of the time to Metallography.

### GENERAL ROUTINE WORK

A. A complete analysis of brass, bronze, nickel silver, cupro-nickel and other alloys from the mills, casting shops and manufacturing departments.

B. Outside samples. This includes samples submitted by customers, our New York, Boston and Chicago stores, and any new alloys which might be put on the market.

C. Analysis and control of the pickle tubs in the rolling and wire mills. Weekly determinations of the free sulphuric acid in the pickle is made and the proper amounts of oil of vitriol are added. This procedure has resulted in a large reduction in the amount of acid formerly used and has cut down the time required to pickle the metal.

D. Analysis of raw materials such as zinc, copper, nickel, manganese, phosphor-copper, tin, lead, antimony, coal, etc.

E. Analysis of steels, greases, oils, lacquers, paints, acids and chemical used by all departments.

F. Analysis and control of plating and finishing solutions and dips in the Plating and Dip and Cleaning Rooms. One chemist is assigned to analyze all copper, brass and nickel plating solutions, dips, coloring solutions, cleaning solutions, and make a weekly report expressing the results in ounces per gallon. He is also expected to see that all anode and cathode connections are kept clean and figure out the necessary chemicals to be added.

### CONTROL AND ANALYSES OF SUPPLIES FOR THE PLANT

Under this head comes the drawing up of specifications for the purchase of materials to be used throughout the plant, and cooperation with the purchasing and requisition departments to see that shipments conform to the specifications.

In making a specification it has always been our aim that it should represent in its final form the result of cooperation between the producer and consumer.

### COMPOUNDING OF OILS AND GREASES AND BUFFING COMPOSITION

At the present time we are successfully compounding many of our oils, greases, cutting solutions, etc., belt dressing, cup greases, lacquer, cutting compounds for automatic screw machines for both steel and brass; cutting and drawing compounds for shell work; high and low pressure, cylinder oils, gear grease, typewriter oil; lantern oil for watchmen's lanterns; metal oil used on the metal when rolling brass, nickel silver, etc., mold oil for dressing the iron molds in which brass, bronze, nickel-silver and other metals are cast; tool hardening and tempering oils, and buffing compounds. The raw materials and finished product are analyzed to see if they fulfill the necessary requirements.

### BILLET CONTROL

All billets for the extrusion machine are analyzed and classified according to analysis before being extruded.

### METALLOGRAPHY

One of the best definitions of Metallography is that of Desch who gives it as "the study of the internal structure of metals and alloys, and its relation to their composition and to their physical and mechanical properties."

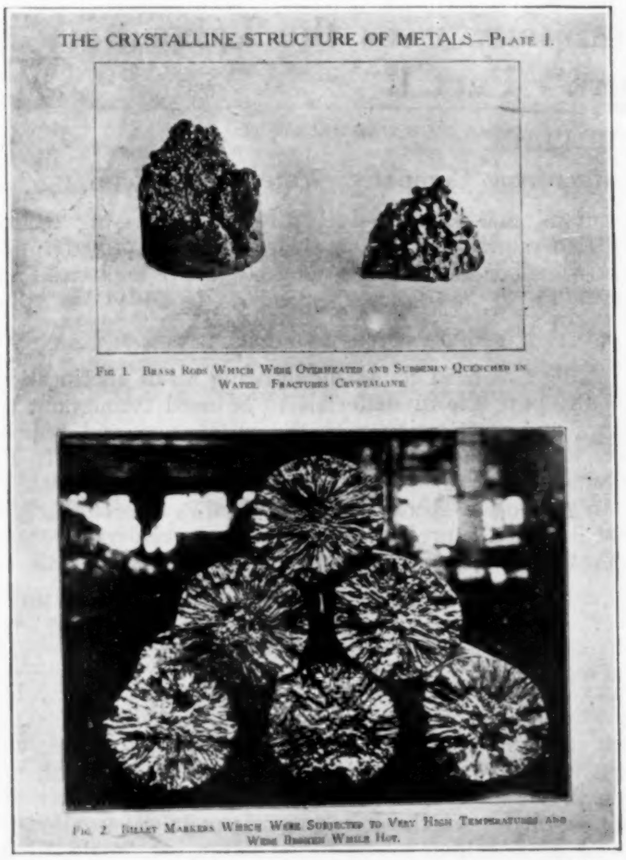
*A lecture delivered before the Rotary, Kiwanis and Lion's Clubs, Waterbury, Conn., during the past year.

The business of the Metallurgist is to study the internal structure and diseases of metals in the same way as a doctor is called upon to diagnose the ailments and diseases of the human body.

Present day requirements and competition demand that we should have a better understanding of the technical end of the brass business than in the past. In other words, standardization, which is the keynote of the great success of the automobile industry, must be applied to the brass business if we are to keep abreast of the times.

### THE STRUCTURE OF METALS

All metal are made up of a mass of tiny irregularly-shaped blocks or crystals. Ordinarily, these blocks fit so tightly, and are so well cemented together, that even when a piece of metal is broken it is difficult to make out the crystalline structure. Occasionally it happens, however, that metal becomes over-heated, which results in the growth of very large crystals. If this metal is then broken while hot, fracture will sometimes take place across the crystal boundaries and will reveal the crystalline structure. Such a condition is shown in Plate I. Fig. 1 represents two pieces of brass rod containing about 56



THE CRYSTALLINE STRUCTURE OF METALS—PLATE I.

FIG. 1. BRASS RODS WHICH WERE OVERHEATED AND SUDDENLY QUENCHED IN WATER. FRACTURES CRYSTALLINE

FIG. 2. BILLET MARKERS WHICH WERE SUBJECTED TO VERY HIGH TEMPERATURES AND WERE BROKEN WHILE HOT.

PLATE 1. THE CRYSTALLINE STRUCTURE OF METALS

per cent copper, which had been annealed at a very high temperature and had cracked when suddenly quenched in water. You will note the large crystal faces. A most remarkable case of coarse crystallization in brass is illustrated in Fig. 2. This represents a number of billet markers or short billets which were placed in the annealing muffles together with regular stock, and were heated up previous to extrusion.

As these markers simply serve to separate different lots of metal, they are not extruded, but are dropped from the furnace to the floor in a red hot condition and are used over and over again.

Continued heating at high temperatures coarsens the crystals so much and makes the metal so brittle that occasionally, when a marker is dropped, it will fracture as shown. Some of these crystals are actually as large as a hen's egg.

### EXAMINING METALS UNDER A MICROSCOPE

In order to examine a piece of metal under the microscope it is necessary to grind it flat and then polish it on various grades of emery until a mirror-like surface is obtained. The specimen is then etched with a suitable reagent, such as strong ammonia water with a dash of hydrogen peroxide. This dissolves away the polished surface and develops the structure. The specimen is then examined under a microscope. This also has a camera attachment for photographing the structure at any desired magnification.

### THE MICROSTRUCTURE OF BRASS

Ordinary brass is essentially an alloy of copper and zinc, which is usually cast in the form of a slab or bar. In the process of manufacturing brass sheet, the bar is cold rolled. Continued rolling hardens the metal very much, so that when thin sheet is desired, it is necessary to soften the metal between the various reductions. This is done by heating the metal or, as the mill men say, by "annealing" the metal. When brass is hardened by rolling, or is softened by annealing, its internal structure changes to correspond with the change in properties.

Plate III illustrates some typical micrographs of brass. The structure of ordinary annealed brass is shown in Fig. 1. Rolled brass is shown in Figs. 2, 3 and 4. Here the

TYPICAL MICROGRAPHS OF BRASS—PLATE III.

FIG. 1. ANNEALED BRASS

FIG. 2. SAME AS FIG. 1, BUT ROLLED 2 NUMBERS (B. & S.) HARD

FIG. 3. SAME AS FIG. 1, BUT ROLLED 4 NUMBERS (B. & S.) HARD

FIG. 4. SAME AS FIG. 1, BUT ROLLED 6 NUMBERS (B. & S.) HARD

COMMON HIGH BRASS.
Mag. 75x. Etch $NH_4OH + H_2O_2$

PLATE 3. TYPICAL MICROGRAPHS OF BRASS

crystals have changed their shape, being elongated in the direction of rolling. The fine lines you see on the surface of some of the crystals do not indicate that the metal has been ruptured during the rolling operation; they simply show where the metal has slipped along certain of the slip planes present in the crystals themselves. Other slipping has probably taken place along the various crystal surfaces.

### CASTING SHOP PROBLEMS

The microscope has helped us to clear up many mysteries in the casting shop. Of course, it is of first importance that the metal should be cast sound, viz., free from gas holes and dross. The structure of an unsound bar of cast brass is shown in Plate IV, Fig. 1. Without going into detail, the black spots represent the gas pockets


PLATE 4. THE RESULT OF DEFECTIVE METAL

in the cast metal. Upon rolling, these gas pockets do not disappear, but are flattened and drawn out in the direction of rolling. The edge section of a piece of poor quality rolled metal is shown in Fig. 2; the black lines represent the flattened out gas pockets or blisters. When metal of this nature is used for shell work it causes a lot of trouble, because a shell with a double bottom is apt to be produced. Such a shell sometimes breaks the cut and draw punch as illustrated in Fig. 3.

Faulty casting may also produce metal of non-uniform composition. For example, when a pot of metal is improperly stirred, the resulting bar is apt to be red on one end, while the other end is brass yellow. Such a bar will usually be rejected after the overhauling operation. If it slips into the mill, however, one end of the bar is apt to crack in rolling while the other end rolls perfectly. Such a case shown in Plate V, Fig. 1, shows the "good" end of the bar, while Fig. 2 illustrates the "bad" or hard end of the bar. Note the striking difference in structure, also that the hard portion of the bar is low in copper content.

### THE STRUCTURAL CHANGES PRODUCED BY ANNEALING

Next to casting, annealing is the most important operation in the manufacture of brass. The annealing temperature not only determines the strength of the metal, but in some cases the quality of the finished article. All of the metal furnished to our government and to the Allies during the recent World War had to meet certain physical tests, wich were directly dependent on the character of the anneal at the mill. These specifications called for such close limits that the laboratory was compelled to


PLATE 5. POORLY MIXED METAL

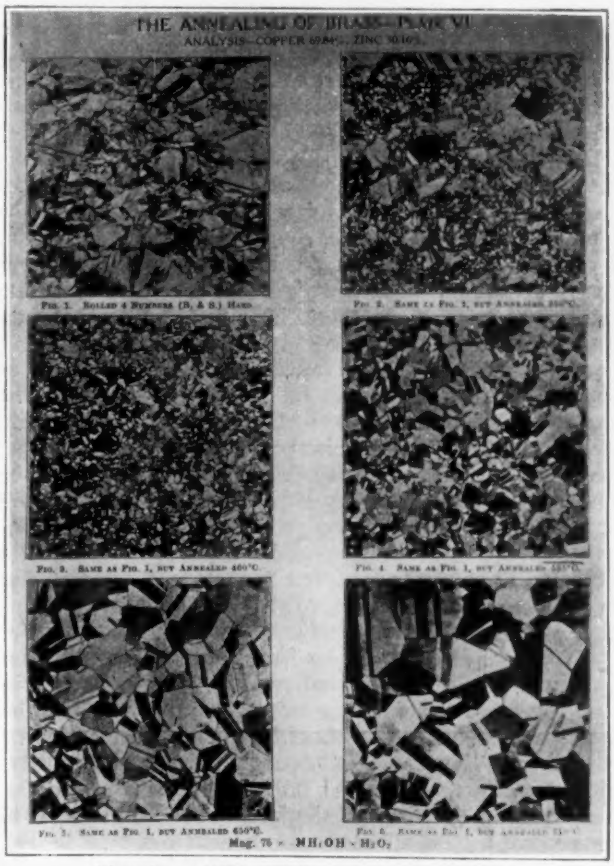



PLATE 6. THE EFFECT OF ANNEALING

supervise the annealing of millions of pounds of metal.

As has been mentioned before, when hard metal has been softened by annealing, a structural change takes place within the metal itself. New crystals make their appearance in between the hard rolled out crystals until, when the metal has obtained a dead softness, the old drawn out crystals have disappeared and a new growth has taken place. This condition is illustrated in Plate VI. Fig. 1 shows the hard rolled metal. Note the elongated, strained crystals. Fig. 2 shows the same metal annealed at 350°C. You will note that small crystals have grown along the old large ones. The appearance of the small crystals indicates the beginning of softening. Fig. 3 shows the effect of an anneal at 460°C. You will see that the old crystals have disappeared, and small new ones have taken their places. Upon annealing at still higher temperatures, the crystals become larger, as shown in Figs. 4, 5 and 6. This illustrates that the character or the structure of the metal can be controlled at will, by using the microscope.

**This paper will be concluded in an early issue.—Ed.**

# Annealing Furnaces

## A General Outline of the Principles of Annealing Furnace Design and Construction

**Written for The Metal Industry by WILLIAM MASON**

Two methods of annealing are used commercially: the "open" method, in which the metal is exposed to the gases from the fire and in which oxidation unavoidably takes place, and the "closed" method, in which the metal is enclosed in an externally heated chamber. In this latter method, with proper care, no appreciable amount of oxidation can occur, as a reducing or neutral atmosphere is maintained in the annealing chamber.

The process of annealing consists of exposing the metal to heat for some hours to permit microstructural alteration in the metal; it differs from "drawing the temper." All internal stresses are removed when annealing is properly done, although in rolling mills and wire mills the non-ferrous metals are sometimes annealed to enable the manufacturing processes to be carried out.

### DOWN DRAUGHT FURNACES

Furnaces are designed for particular purposes, for which reason it is not possible to do more than indicate a type of furnace, which by modification, can be made to suit the particular work to be done. For practical use probably modifications of the down draught furnace will be found most useful, as by a little care in charging, practically the whole of the heat can be placed to useful effect prior to reaching the exit flue. In this form of annealing furnace the heat travels over the hearth from fire to flue exit, and as the charge is put in, surrounds and rises over and through the mass of metal when it is properly arranged. The heat is even, but given a strong enough fire much more than the annealing temperature of from 750°C. to 850°C. could be secured.

Long flame coal is used as fuel, and a hearth up to 15 ft. in length or more can be adequately heated. The objection to open furnaces is the amount of oxidation caused, but by proper manipulation of the fire this can be kept to within reasonable limits. The means to be arranged to effect this are chiefly concerned with having thin firebars closely arranged to save loss of fuel, but allowing plenty of draught, and the maintenance of a moderately thick firebed of not too close a texture, but without holes or dead places, so that no free air shall pass until it has been largely deprived of its oxygen.

Small coal is not good as a fuel, but a discrimination as to the range of sizes used must be made, as a free burning and hot fire is necessary, particularly when the hearth is a long one. For short hearths a modification of the fire is necessary both in regard to size and intensity, but in no case may air in an unburnt state pass into the furnace beyond the fire, particularly where thin metal is being annealed. In all cases the hearth must be heated before metal is put in, and as a general thing the furnace should be kept heated until work is done for the week, thus saving both fuel and cost in repairs. In this form of continuous heating large fires are not wanted except while annealing, thin fires of cinders, or broken gas coke, and coal in combination being good enough to keep the furnace hot during the night and at week ends, provided they are kept free from holes and dead places. The draught should be well reduced so that too rapid combustion of the fuels is thus prevented.

As there is a considerable amount of strain on furnaces of this kind, it is desirable that they should be well supported on the outside by plates held together at top and bottom with tie-rods, which can be adjusted for expansion. To prevent damage as far as possible, the charging door should be lined with fire-brick, which is not a difficult matter to arrange. The size of the erection determines the exact method of staying adopted, and as drawing for each size of furnace should be prepared, the whole of the details should be dealt with in each case, although the general design may be the same in all cases.

A general idea of size may be gained from the plan, Fig. 1, and the longitudinal section, Fig. 2, which are for a fairly large furnace. For small goods only, a shorter furnace should be built, unless very large numbers have to be dealt with. In any case, two hours at full heat is the lowest that can be allowed for any charge, while in many cases from seven to eight hours become necessary to secure proper results. To draw the temper of a piece of tempered steel takes only a few minutes, but to alter the structure of metal takes prolonged heating, the bulk of the metal ereated deciding the time required. This is a point which has to be considered when laying down furnaces. In the illustration A is the sand over the arch, B the annealing chamber, C the hearth, D the earth filling, E the fire space, F the ashpit, G the flue, H the door, and I the damper.

Usually upright walls one brick in thickness are sufficient, single-brick arches being used with a bed of sand overlying them as a cover. All surfaces exposed to heat must be of good refractory firebrick, and fire lumps should be used for the edges of the annealing hearth where the fire impinges. The simplest method of construction is shown in the cross section, Fig. 3, the space under the hearth being filled with dry earth or foundry sand rammed tight; but this is not an essential, as the hearth can be carried on arches if preferred. The hearth is of pebbles or cast-iron balls of about 2-in. in diameter over a brick floor, as indicated. Pebbles are often selected on account of their cheapness, but they must be dry, and where used a stock should be kept in a dry, well-ventilated shed.

The fire end of the furnace should be constructed so

that the air is compelled to pass through the fuel, as nothing of a regenerative character is needed. A section is shown in Fig. 4, which should be sufficiently explanatory; but care must be taken to provide sufficient ashpit space, so that ample air reaches all parts of the fire and all air passes through the fire and not over it. Close-fitting doors for charging fuel must be provided, and usually it will be preferable to have the door in the position shown unless strong reasons for some other position exist.

The exit flue is in the front of the furnace close to the door for charging the articles to be annealed; the general arrangement is shown in Fig. 5, the main flue being carried to the chimney below the floor level, and governed by a damper attached to each furnace where more than one is used. It is necessary that a good draught should exist, as otherwise a sluggish, smoky furnace will result; but by a judicious use of the damper the bulk of the heat generated by the fuel can be held on the hearth. The inlet from the furnace would be from 2 in. to 4 in. wide, and extend from side to side of the furnace. Where necessary one or two fire bricks used as baffles directing the course of the draught into the flue should be used. Fire lumps should be used for the edges of the flue, and in rare cases these may be edged with stout angle iron to prevent breakage, although with careful use this will not be required.

The firebars should be thin and deep enough to prevent local heating, and if arranged as shown in Fig. 6 should prove satisfactory. Some fuel is, of course, lost through passing through the firebars, and this may be largely recovered if the ashes are sifted through a fairly small meshed sieve, which will pay for doing if there is any use for the fuel. Having the firebars deep in section the air drawn through them keeps them cool, while becoming warmed itself, both being points of advantage, and particularly so where the firebars are kept at a low temperature, as this prevents excessive warping. Where much clinker is made, however, local heating is certain to occur, with warping as a sequence.

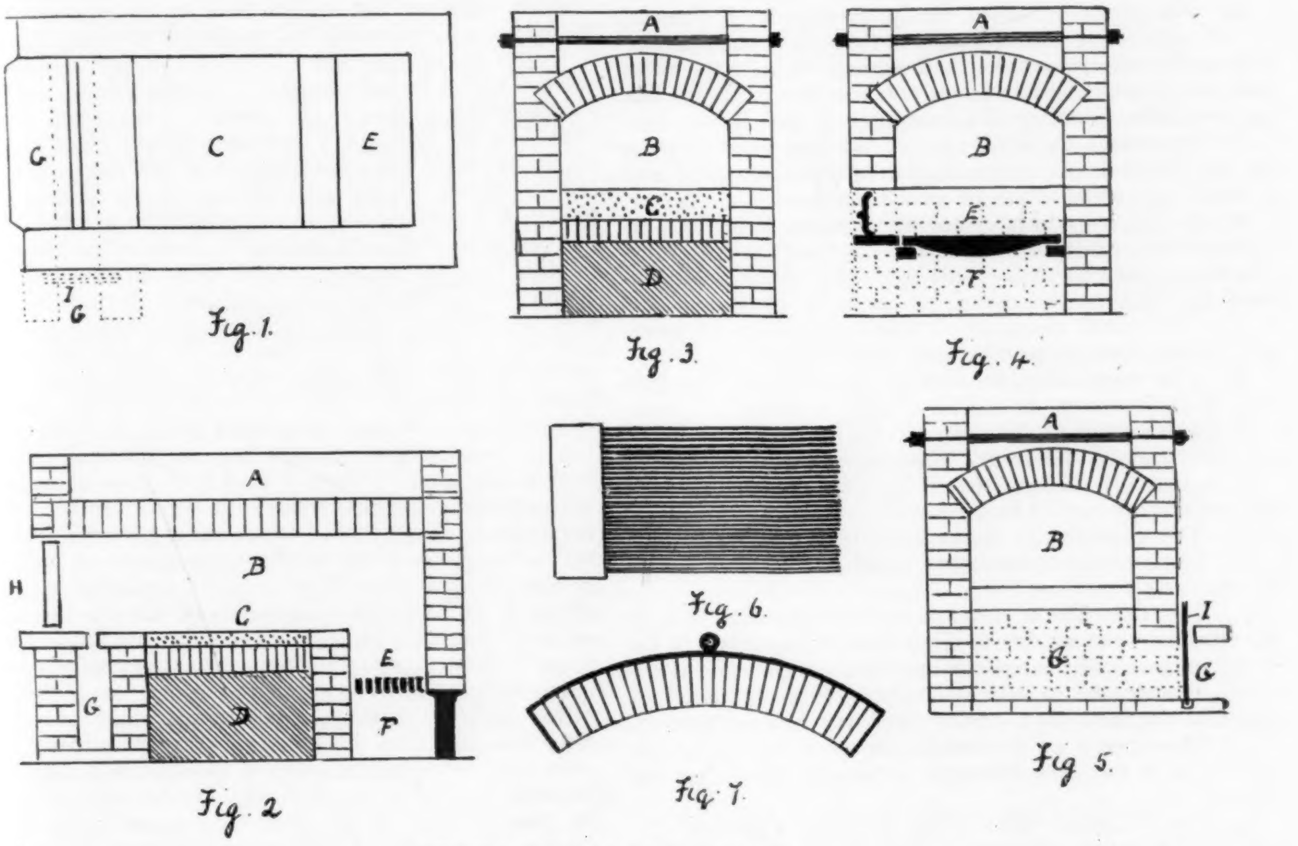
Coal should not give more than about 12 per cent ash by weight where it is of good quality, but up to 15 per cent may occur in some coals which give very good heat. Coals holding pyrites or sulphur in excess would not be suitable for annealing in open work, as sulphur injuriously affects iron and steel.

In putting in the arches a good method is to make them up with an iron band as shown in Fig. 7, lifting them bodily into place and grouting with fireclay, as this, to some extent, eases the thrust caused by heat expansion while simplyfying construction. The bands should be made of about 3 in. by ⅜ in. flat iron, and old wheel tires can be purchased at less than the cost of new iron for this purpose.

It is good policy to have a sight-hole on each side of the charging door, mica being used as a covering to prevent the admission of air to the interior. This permits of the arrangement of the articles to the best advantage where they are of irregular shape, and allows of adjustments where such are necessary to secure equal heating.

Proper tongs with long reins and some simple tools convenient for handling the charges are necessary, the exact things depending on the work done. Dry fine sand, that from a foundry fettling-shop being as good as any, is also necessary to cover the annealed articles while cooling, thus enabling the furnace to be kept in continuous operation.

Where drawing or other operation of a like character have to be done on the annealed work, pickling tanks to remove oxide, and a drying floor, which may be heated by the flues from the furnace, will have to be provided.




DETAILS OF ANNEALING FURNACES

# Refractories for Metals

## Preliminary Report of Subcommittee on Survey of the Non-Ferrous Foundry Industry for the American Foundrymen's Association*

By H. M. ST. JOHN, Chairman

Brass casting shops in the United States, exclusive of brass rolling mills, can be divided roughly into four classes:

1. Founderies which normally operate their furnaces at full productive capacity on a small number of alloys, with little day to day variation in melting practice.
2. Foundries which normally operate their furnaces at full productive capacity with but alloys of widely varying composition, poured into a variety of castings under conditions which differ greatly from day to day. The large jobbing foundry is an example of this type.
3. Foundries which commonly operate their furnaces at less than full productive capacity but do not deal with a large number of alloys or varied products.
4. Foundries which commonly operate their furnaces at less than full capacity and also deal with widely varying alloys and products. This is typical of the small jobbing foundry.

The individual items which affect refractory performance in the foundry may be listed as follows:

1. The type and size of furnace used and the fuel used with it.
2. The rate of production, that is, the average number of hours out of the twenty-four, during which the furnace is actually melting metal, and the degree to which the melting process is being forced.
3. The number and composition of the alloys melted.
4. The average temperature at which the metal leaves the furnace.
5. The presence of foreign non-metallic materials in the furnace whether due to dirty metallic materials in the charge or purposely introduced as fluxes or covering slags.
6. The degree to which the furnace is kept clean of slag and the methods used for removing it when present.
7. The nature of the refractory used for lining the furnace and the care taken in preparing the lining for service.
8. The frequency with which the lining is patched, the nature of the patching material used and the method of mixing and applying it.

A questionnaire embodying the above items was sent to 225 representative brass foundries. Eighty-three replies were received, a return of approximately 37 per cent. This proportion of replies is considerably higher than is usually the case with questionnaires and is considered very gratifying. The information received in these has been supplemented to some extent by verbal information received from other plants. While the foundries which have given us information probably comprise less than 25 per cent of the total brass melting capacity of the country (exclusive of rolling mills) it is believed that the information received is fairly representative of general practice. Foundries of all four types mentioned above are well represented and an exceedingly wide variety of operating conditions is found in the replies.

### FURNACE TYPES AND FUELS

In 1914 Gillett[1] listed 27 types of furnaces commercially used in melting brass. This did not include several types of electric furnaces, now used, which had not then been sufficiently perfected for practical use. For the purpose of this investigation a less minute subdivision may be employed and the furnace types now in use may conveniently be classified in eleven groups as follows:

A. Using coke or hard coal
  1. Crucible pit
B. Using soft coal
  2. Crucible pit
C. Using oil or gas
  3. Crucible pit
  4. Crucible tilting
  5. Open flame tilting.
  6. Open flame rotating
  7. Reverberatory
D. Using electricity
  8. Indirect resistance
  9. Indirect arc, rocking or rotating
  10. Induction
  11. Direct arc.

In ordinary foundry practice, types 1, 3, 4, 5, 6 and 9 are in common use and will receive principal consideration in this report. Type 2 is of little present importance although in a modified form it may possibly be of future importance. Type 7 is of important use in smelting plants for melting down and refining low grade or badly contaminated materials. Type 8 is of declining importance if one is to judge by comparison of the number of furnaces of this type in present use with the number in use three or four years ago. Type 10 is very widely used in brass rolling mills but its present use in foundries is rather limited. However, its potenial importance is considerable and, since its limitations are principally due to refractory problems, it deserves substantial recognition in this report. Type 11, while the favorite electric furnace for steel melting, is not suited for use with brass foundry alloys. It is believed that its employment for such purpose is confined to intermittent use in a single plant. Other furnace types have been suggested and may in the future become of importance, but the scope of this report is limited to a survey of present conditions and too wide a speculation as to the future would be out of place. Under this head may be included a number of electric furnace types, reverberatory crucible furnaces and furnaces using powdered coal.

### FURNACES USING SOLID FUEL

This classification includes groups A and B and is limited to crucible pit furnaces. Twenty-five plants reported the use of furnaces of this type, melting a daily total of 324,000 pounds. This represents a total of 30.1 per cent of the plants reporting but only 18.5 per cent of the total melted. Out of the 25, two plants use these furnaces intermittently only, while 11 others depend on other furnaces for at least a substantial proportion of their melt. Twelve plants, four of which melt 10,000 pounds of metal or more per day, depend upon this type of pit furnace exclusively. Of the 25 plants, 21 use coke as a fuel, three use hard coal and one uses soft coal.

The life of the pit linings varies from 100 heats to 1,500

* Abstracted from a Report read at the Detroit meeting, September 27-October 1, 1920.

[1] Gillett, H. W., U. S. Bureau of Mines Bulletin 73, Brass Furnace Practice in the United States, p. 17.

heats in different plants, averaging 670 heats. Compared with the data collected by Gillett (loc. cit. p.p. 46-47) the maximum life is about the same but the present average is about 90 heats higher than it was in 1914, assuming that the two collections of data offer a fair comparison. In each case about four heats per day from each pit represents average practice. The nature of the fuel does not seem to make as much difference as might be expected, although so few of our replies are based on the use of hard coal that no real conclusion can be drawn. There are no data at all from the one soft coal installation.

The linings of pit fires are customarily built of cupola blocks, ordinary fire brick shapes, or various plastic mixtures rammed into place. The most rapid wear occurs in the ash zone and is due to the fusing of slag and clinkers to the lining. In cleaning the fires these adhering clinkers are usually chipped off with a bar and this process gradually destroys the lining. This is also the region of most intense heat.

After a survey of the data one is forced to the conclusion that the personal element is of predominating importance. Lining would stand up for a long time if they had nothing but fire to contend with, the handling of the bar in tending the fire and in cleaning the pits largely determines the durability of the lining. Variations in this respect are so great as to obscure the effect of other factors. It seems probable that a rammed lining of suitable material, skillfully installed, will outlast a brick lining. It follows also that the same material skillfully used as a patch in any lining will greatly prolong life. In both cases skill is necessary and a little sympathy on the part of the furnace tender is also essential. Average conditions should be greatly improved by the use of a slag resisting material more refractory than common fire brick.

### CRUCIBLE FURNACES USING OIL OR GAS

This classification includes types 3 and 4, Group C. Twenty-five plants reported the use of furnaces of this type, melting a daily total of 157,250 pounds. This represents a total of 30.1 per cent of the plants reporting but only 9 per cent of the total metal melted. In many instances the furnaces are used as spares or for special purposes only. Very few plants depend on this type of furnace for the bulk of their production. Of the twenty-five, eighteen plants use oil exclusively, four use oil or gas while three use gas exclusively.

The average life of the fire chamber linings in different plants varies from 100 to 2,000 heats, averaging 775 for all plants combined. The destruction of the lining is due to the cutting action of the flame and to the decomposition of unburned oil which finds it way into the cracks and pores of the refractory. The replies received by Gillett showed an average of 1,020 heats per lining from this type of furnace.

The linings of these oil crucible furnaces are usually made from common fire brick or from a rammed furnace mixture, the latter being quite popular and usually containing considerable proportion of carborundum. It appears from the data that such a rammed lining outlasts a fire brick lining by about 50 per cent. A glazed surface on the lining before it is put in service is an advantage. Preheating and regular patching help to increase the life of the lining; neither is universally practiced.

### OPEN FLAME FURNACES

These use either oil or gas (usually oil) and include type 5 and 6 of Group C. Forty-one plants reported the use of furnaces of this type, melting a daily total of 682,300 pounds. This represents a total of 49.4 per cent of the plants reporting and 39 per cent of the total metal melted.

The life of these linings varies from 75 to 1,900 heats in different plants, averaging 520 heats when the replies are combined into a composite figure. Detruction of the lining results from the following factors:

(a) Spalling.
(b) Cutting action of the flame.
(c) Fluxing action of floating slags.
(d) Fluxing action of particles of slag thrown against the refractory of the blast.
(e) Mechanical injury due to charging heavy pieces of metal.
(f) Chipping out adhering slag.

In cylindrical furnaces of this type pure brick linings are ordinarily used. In egg shaped furnaces rammed linings are common although furnaces lined with brick and partly with a rammed mixture are rather more usual. Other things being equal, the brick linings seem to stand up better than the rammed linings.

In cylindrical furnaces best results are obtained by running the furnace at about half its rated capacity per heat and taking out a proportionally large number of heats per day. This actually results in the largest tonnage melted per lining. Charging more than the rated capacity of the furnace shortens the lining life materially. In the egg shaped furnace this factor seems to be of little importance.

Best results are obtained by preheating with wood or charcoal, then applying a slow oil fire for several hours. Glazing the surface of the lining before service is beneficial.

Periodical inspection and patching is much better than "patching as needed." The best combination seems to be daily hot patching plus weekly cold patching.

The composition of the metal does not seem to be of great importance, although very high lead undoubtedly has some detrimental effect.

The uses of fluxes is hard on the lining, lime and fluorspar being particularly bad. Really dirty metal, particularly if contaminated with oil or grease, is harmful to the refractory. Furnaces, if reasonably clean, have no detrimental effect.

The slag problem is not likely to be serious if the furnaces are run steadily at a high temperature. Small doses of a mild cleaner (probably with a fluorspar base) are effective under these conditions. More drastic measures, such as the use of salt, lime and fluorspar, or high heat in an empty furnace are destructive.

### INDIRECT-ARC ELECTRIC FURNACES

This includes Type 9, Group D. Twenty-two plants reported the use of furnaces of this type, melting a daily total of 341,950 pounds. This represents a total of 26.5 per cent of the plants reporting and 19.5 per cent of the total metal melted.

The reported life varies from 400 to 4,000 heat and averages 1,350. Destruction of the lining results from the following factors:

(a) Spalling
(b) Fluxing action of floating slags
(c) Mechanical injury in charging
(d) Removing slag
(e) Penetration of metallic vapors and oil.

In nearly all cases a high grade diaspore fire brick is used. Periodical patching is almost universal although details of practice vary widely. Daily hot patching and weekly cold patching gives best results. Preheating is universal although there is considerable variation in the nature and duration of the preheat. Spalling is the most serious single factor in shortening lining life, although penetration of the brick by metallic vapor or oil from the charge is also very destructive in certain plants.

ELECTRIC INDUCTION FURNACE

This classification includes Type 10 of Group D. Six plants reported the use of furnaces of this type, melting a daily total of 78,000 pounds. This represents a total of 7.2 per cent of the plants reporting and 4.5 per cent of the total metal melted. The average life of the linings varies from 700 to 1,500 heats in different plants, the composite average being 990. The refractory lining in the heating portion of this furnace is very thin. It wears through due to erosion by moving metal and due to the penetration of molten metal into cracks and pores of the refractory. At the comparatively low temperatures required for yellow brass the linings are quite reliable and long lived, the regular use of such furnaces is at present limited to metal of this character. The use of this type of furnace for melting foundry red metal depends upon the development of a refractory which will consistently and reliably resist penetration at temperatures upward of 2,500 degrees Fahr.

SUMMARY

1. It is noteworthy that the average experience with refractories falls far short of the maximum obtainable. In many individual instances the reasons for this condition are rather obvious and a very substantial improvement could be made merely by the application of well known and widely used principles. This applies particularly to the operation of open flame furnaces where average practice is much inferior to best practice. A campaign of education appears to be in order.

2. Many plants, even very prominent plants, keep inadequate records. This is particularly true in the case of pit-type furnaces, less true with open flame furnaces, while the records kept by electric furnace users are surprisingly complete.

3. The personal element with respect to the installation and maintenance of linings and the operation of furnaces is of prime importance. Variations in this respect are frequently so great as to obscure the effect of all other factors governing lining life. This, again, is particularly true in the case of pit-type furnaces.

4. In the case of electric furnaces an advanced practice is followed with remarkable uniformity and the result is plainly evident in the excellent results obtained.

5. The larger the furnace, regardless of type, the more difficult are the refractory problems, although larger furnaces usually succeed in producing a greater tonnage per lining, in spite of their short life expressed in heats per lining.

6. A high rate of production is favorable to long life provided the particular refractory used is not exposed to a maximum temperature or fluxing action beyond its capacity to withstand. In certain furnaces the lining life is increased by melting charges of less weight than the rated capacity of the furnaces.

7. In crucible furnaces the nature of the alloy melted is of little consequence except as its required pouring temperature governs the duration of the heat. In hearth furnaces the life of the lining is shorter when melting alloys which tend to produce an excessive penetration of molten or vapor metal into the refractory.

8. The use of fluxes, or the presence of foreign material in the charge, do not affect pit linings, since there is no direct contact. In hearth-type furnaces fluxes are injurious to the lining to a varying extent depending upon the nature of the flux and the quantity used. The presence of oil or water in the charge is also detrimental.

9. It is of utmost importance that hearth-type furnaces should be kept as free as possible from adhering slag and that the methods used for removing slab accumulations should be mild. The use of powerful fluxes, extreme heat in an empty furnace, or mechanical chipping, are all damaging to the refractory.

10. In pit-fire linings to be used with a solid fuel, the refractory used should have the least possible tendency to soften on the surface in order that it may keep free from adhering clinkers. When oil or gas are used the refractory must be of such a character as to resist the cutting action of the flame and retard penetration of unburned fuel into the lining. In both cases it is probable that rammed linings offer the best line of development.

11. In hearth-type furnaces brick should be used so far as possible. The refractory must have a maximum resistance to spalling and at the same time be dense to prevent penetration by metal or oil. This rather paradoxical requirement is of especial importance in electric furnaces of the indirect-arc type. Resistance to chemical action by slags and fluxes is also of great importance.

12. Carefully preheating the lining is of paramount importance, particularly with hearth-type furnaces. Probably no other one factor has a greater influence on linings.

13. Patching linings is an art. It is next to impossible to give definite instruction covering its technique. It can be said, however, that frequent inspection and patching is of utmost importance. In the case of hearth-type furnace linings should be inspected daily and every sign of incipient failure should be corrected by hot patching. Thorough cold patching should be practiced once a week. There are a multitude of patching cements on the market and most of them are good when properly used. Some require more skill in their application than do others. A suitable patch is one which will "stay put" indefinitely and will possess all of the good qualities of the original refractory. Making it stay put is the real problem.

## Alloys for Bushings

Q.—We are desirous of obtaining a bearing alloy for bushings. These bushings are used on a 3 15/16" diameter shaft which revolves about 450 r.p.m. This shaft not only causes a whipping action of the bushing, but the whole part is immersed in a hot crude oil which has a temperature of between 800° and 900° F. We find the bushings we are using are harder than the shaft at this temperature which results in the shaft wearing instead of the bushing. Can you advise us of a good alloy to use for these conditions?

A.—We would suggest the following alloy for this work: 70 copper, 26 lead and 4 tin. As this alloy is rather hard to handle it may be best to buy the ingot from a reliable smelter. We are quite sure if you use this alloy properly alloyed you will eliminate the trouble you are having to a minimum.—W. J. REARDON.

## Pouring Battery Grid

Q.—We are experiencing difficulty in that when our battery grid is poured in the mould, faint cracks occur in the heavier section of the grid.

You can very well understand, that if this grid is put into a battery, after a very short life, the acid attacks the part that is cracked and the plate will break off.

We have this matter under research at present and will indeed appreciate any light that you may be able to throw on the subject.

A.—We would assume that this trouble would be caused by pouring the metal too hot; also by getting too many impurities in the lead. With a good grade of lead, poured at the proper temperature, and the lead cleaned by stirring well and fluxed with a mixture of resin and sal-ammoniac; very little trouble should be had from cracking.—W. J. REARDON.

# The Fundamentals of Brass Foundry Practice

## A Description of the Basic Laws Which Control the Melting and Casting of Metals and Their Application to Practical Foundry Operations*—Part 5

**Written for The Metal Industry by R. R. CLARKE, Foundry Superintendent**

### RADIATION AND CONCRETION

Radiation is the throwing off of heat. It varies with the material, the surface exposed and nature of surface. A 6-inch cube and a 24 inch x 9 inch x 1 inch flat plate contain equal volumes, but the plate surface is more than double the cube surface and gets rid of heat much faster. In engaging liquid metal, if a surface be cold, or of high heat conductivity, the cooling rate will quicken as compared to the opposite of these conditions. Radiation can, therefore, be said to vary with the area, temperature, and conductivity of the material. The cooling rate of any casting or section thereof will respond to any or all these influences. See Fig. 13.)

By concretion we mean the solidification of metal. It

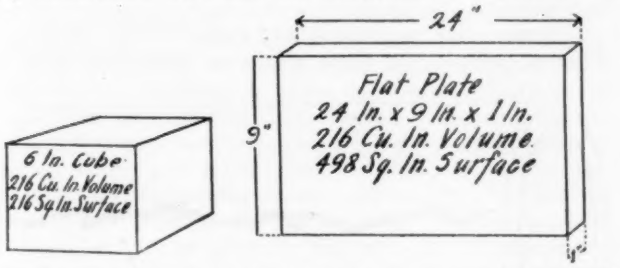



FIG. 13—VOLUMES AND WEIGHTS OF CASTINGS ARE THE SAME BUT THE RADIATING SURFACE OF THE PLATE EXCEEDS THE CUBE BY 282 SQUARE INCHES. The plate will radiate heat much faster. The effect of shrinkage in the cube will most likely show in cope surface depression and a cavity or fracture in and around or above the center of mass. In the plate the effect is likely to take the form of a plane of cleavage near the middle of the plate and parallel to the plate's greater surfaces.

varies with ratio of volume to surface rather than with the area of the surface. A sphere and a cube may have the same surface area, but the sphere will have a greater volume than the cube, its ratio of volume to surface is greater, and it will therefore solidify more slowly. (See Fig. 14.)

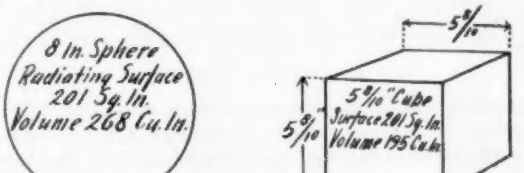



FIG. 14—THE 8-INCH SPHERE AND THE 5-8/10 INCH CUBE CONTAIN EQUAL SURFACES (201 SQUARE INCHES). The sphere has 268 cubic inches in volume, the cube 195 cubic inches. The cube will therefore solidify more rapidly and be solid throughout considerably in advance of the sphere. Effect of shrinkage in both will be cope surface depression and cavities or fractures in and around or above the centers of mass.

### VOLUME AND SURFACES

Further interesting and practical facts concerning volume to surface can be studied from Fig. 15 which represents three spheres 12, 6 and 3 inches diameter respectively. In order their volumes are 904-113 and 14 cubic inches, their surfaces 452-113 and 28 square inches.

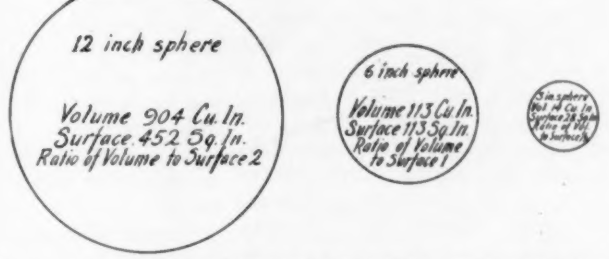



FIG. 15—AS BODIES INCREASE IN SIZE THE RATIO OF VOLUME TO SURFACE INCREASES. Consequently concretion and molding practice must vary. Also, although the diameter of the largest sphere is only four times the diameter of the smallest sphere, the volume of the largest sphere is 64 times that of the smallest sphere.

Ratio of volume to surface in each is about 2-1 and ½. From this it can be seen that as the sphere decreased in size the ratio of volume to surface became smaller. If the sphere were reduced to 1 inch diameter it would contain 6 times more surface than volume. This is true of all bodies or castings, that the smaller they are the greater the ratio of their surface to their volumes, and the more rapidly they solidify. Another particular worth noting is that the 12-inch sphere contains 64 times the volume and 16 times the surface of the 3-inch sphere. Their volumes are to each other not as their diameters but as the cubes of these diameters; their surfaces, not as like dimensions, but as the squares of these like dimensions. This is also true of all similar volumes and surfaces; they vary not with like dimensions but with cubes and squares of like dimensions respectively. The principle has a very practical application in molding—that certain measures in gating and feeding will satisfy contraction in the 3-inch sphere is no logical argument that 4 times those measures will answer in the 12-inch sphere, because ratios between the two spheres are radically different from that of their diameters.

Volume to surface is important in the gating and feeding of castings and in those surfaces where heavy

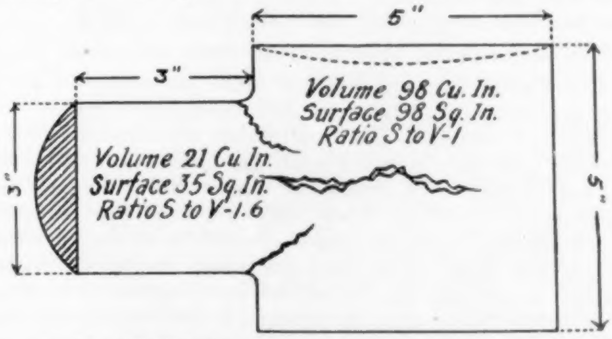



FIG. 16—BY VIRTUE OF THE GREATER RATIO OF SURFACE TO VOLUME, THE SMALL END WILL SOLIDIFY FIRST, BEING FURTHER AIDED BY ITS SMALLER BULK. In solidifying it will pull on the semi-fluid or plastic mass of the heavier end, causing inner cavities, or line fractures in the heavier end at the center of mass, and most likely lines of cleavage and rupture at the union of the two sections. The example aptly illustrates varying bulk in similar forms and constitutes a frequent source of shrinkage trouble in the foundry. The combined effects show up plainly in castings of this type. Effect of shrinkage will show a sunken top surface as per dotted line and inner cavities and cleavage lines.

---

 This series will be collected and published in book form. Parts 1, 2, 3 and 4 were published in our issues of July, August, September and October, 1926.

and light bulks lie adjacent to each other in the mold. Figure 16 illustrates a round pin of the two diameters and sectional lengths 3 and 5 inches respectively. In order the volume in each section is 21 and 98 cubic inches; the surface 35 and 98 square inches. Surface to volume in the small section is 1.6; in the larger section 1. Because of its greater surface ratio as well as its smaller bulk the small end section will solidify first and levy shrinkage toll on the heavier end to appear in the casting unless corrective measures are taken. The effect may express itself in inner cavities or in cleavage lines, depending upon the state of fluidity of the metal at the time the final draw is made on it. From a foundry standpoint, concretion is further influenced by the time and temperature factors which can be examined in connection with Figure 17. Molded vertically, heavy end up and bottom poured, the heavier upper volume at the finish of pouring will be colder than the lighter lower volume and will set more nearly in point of time with this lower volume. The difference in mass between the two is simply neutralized by the difference in temperature brought about by the longer time taken to deliver the metal to this heavier volume in the mold. It is fairly safe, then, to say that concretion varies with ratio of surface to volume, with mass and with relative temperature, and proceeds from bounding surfaces to center of mass in the casting.

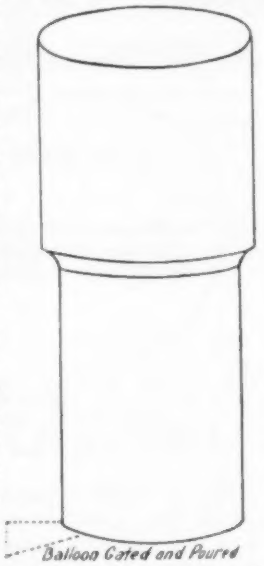



FIG. 17—RELATIVE TIME AND TEMPERATURE OF METAL DELIVERED TO THE CASTING AND ITS PARTS AFFECT CONCRETION AND SHRINKAGE. This casting is molded in position and bottom poured. Metal at finish of pouring is colder in the heavy top volume than in the lighter lower volume, because of the longer time taken to deliver the metal to the top volume. But the difference in temperature is adjusted by difference in bulk so that the two sections will solidify more nearly together in point of time. Gated at the top this temperature difference would be out of favor with relative concretion in the two sections.

By center of mass we understand that point in the casting at which the casting will balance if suspended. It is the heart of the casting and the last to solidify. There the last changes of concretion are made, the final quotos of contraction taken. Unless fed with a replenishing supply it cannot be perfectly solid. Every casting gated and poured contrary to the radiation and concretion principles is at heart more or less defective. The surface may never show it, the machine tool never reach it, but it is there.

### EXPANSION, CONTRACTION AND COHESION

Correlating the activities of these principles in molding are those of expansion and contraction and of cohesion! Expansion and contraction are opposite forces coming into play in order with the application and withdrawal of heat and producing respectively increase and decrease of volume. They vary with the heat supplied or withdrawn, with the mass affected, with the different metals and their alloys and are most dangerous to the casting at or near the instant of its complete concretion. It is shortly before this instant and at this instant that the inner cavities and the heavy cleavage lines are drawn. Contraction varies perceptibly in the different metals and their alloys, and these metals and alloys in their semi-fluid states as well as in their plastic-to-solid states differ widely in their physical properties. Thus an inner cavity or a shrunken surface in a copper casting might under identical practice never show up in an iron casting. It certainly could occur in copper and not in the average copper alloy. Similarly a high zinc-copper alloy may crack under cooling strain (Fig. 18) but escape this cleavage entirely by having a small percentage of lead in the same alloy. Any foundryman of experience knows the difference in shrinkage between steel and iron, between copper and aluminum, between high zinc and low zinc copper alloys, between high tin and low tin copper alloys, between three and four-metal alloys and two-metal alloys, etc. It is knowledge of these varying tendencies, proportions and their remedies that constitutes one of the fundamental requisites of successful founding.

Cohesion is the binding force of matter, the force by which its particles are held together in a mass. The word means holding together and differs in this respect from adhesion which means sticking to. In liquids, cohesion, though not entirely lacking, is yet weak and particles separate readily. But as the liquid returns to its solid state through its semi-fluid and plastic states, cohesion increases. Molders sometimes wonder at a hole occurring in a casting directly under a riser; that a riser would literally lift metal upward out of a casting rather than feed metal downward and into a casting. They need only understand that the pull of shrinkage in the congealing metal of the riser and the force of cohesion on the plastic mass centre of the casting are both stronger than gravity.

Cohesion, like expansion and contraction, varies in the different metals and their alloys in their semi-fluid and

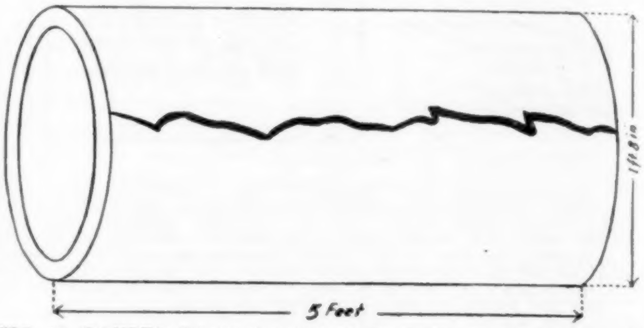



FIG. 18—POURED WITH AN ALLOY OF HIGH SHRINKAGE AND LOW PLASTIC COHESION. The cylinder cracked in cooling as per sketch. The alloy (copper 70-zinc 30) was changed to copper 75, zinc 23, lead 2, poured around the same core. On second melting of the alloy the cleavage was overcome, illustrating difference in expansion and contraction of different metals and alloys and variations in plastic cohesion among these different metals and alloys.

plastic states. From a foundry consideration it is enough to say, therefore, that cohesion varies with the fluidity of liquid metal and with the different metals and alloys.

### REMELTING METAL

Regarding the non-ferrous metals and alloys it might be further noted that both shrinkage and cohesion are perceptibly influenced by the re-melting of the metal or alloy at least once before pouring into molds. There is a rawness about virgin metals and alloys that seems either to increase shrinkage or weaken cohesion or both. This is especially true of the alloy and suggests the possibility that chemical reactions, incomplete in first melting and alloying, affect physical conditions and properties. At any rate almost any non-ferrous alloy will shrink, draw, crack and cleave less and show a finer grain in the casting on second than on first melting. This is one of the established facts of the author's experience and a remedy to which he has resorted many times. Examples without number might be submitted where cleavage between light and heavy sections, annular cracks, surface depressions, partition of metal, etc., were in part overcome by the re-melting of the metal.

**This series will be continued in an early issue.**

# Smelting Secondary Aluminum and Aluminum Alloys

## A Series of Articles on the Reclamation of All Forms of Scrap and Used Aluminum and Aluminum Alloys.

## Part 5. Oxidation on Smelting and Its Prevention

Written for The Metal Industry by Dr. ROBERT J. ANDERSON, Consulting Metallurgical Engineer

In studying the question of smelting as applied to aluminum, two properties of the metal must be considered, viz., (1) its ease of oxidation (as well as nitridation), and (2) the difficulty with which small globules of liquid aluminum coalesce owing to the coating of aluminum oxide (or dirt) or to the effect of surface tension, or both. The affinity of aluminum for oxygen is very great, and this fact accounts for the high losses involved in smelting certain types of scraps unless proper precautions are taken. Much experimental attention has been given to the oxidation of aluminum, and in the recovery of scrap the chief concern of the metallurgist is the prevention of oxidation. This is one of the most difficult problems to deal with in secondary practice. High oxidation losses on smelting mean low recoveries and determine whether a plant can operate profitably or not.

Preliminary treatment of both drosses and borings is necessary for efficient smelting in order to prevent excessive oxidation and secure maximum recovery, as will be explained fully in a later article in this series. In the case of drosses, the object of the preliminary treatment is to remove as much of the non-metallic (oxide) content as is possible. The greater the amount of aluminum oxide present in drosses as smelted, the greater the metal loss, since the oxide acts to prevent coalescence of the free metal. In dross smelting, the essential requirement is to effect detachment of the oxide and force coalescence of the liquid globules of metal (large and small) into one mass. The problem in running borings is to prevent oxidation of the small particles so far as possible and to force coalescence of the melted globules. Clean borings can, of course, be smelted directly without preliminary treatment and run down with comparatively small oxidation loss. The loss on smelting dirty and oily borings is larger than with clean borings because the dirt forms a film or coating on the individual particles and hence hinders coalescence. In the present article the questions of oxidation, nitridation, coalescence, and the prevention of oxidation are discussed briefly.

### OXIDATION OF ALUMINUM

As is well known, metallic aluminum (and its light alloys) is normally covered with a thin film of aluminum oxide, $Al_2O_3$, since the metal oxidizes at the ordinary temperature in the presence of air. The thin film of aluminum oxide formed on the metal at temperatures below the melting point acts effectively in preventing further oxidation. Thus, Utida and Saito[1] find that when aluminum wire is heated at 500° and 600° C. its surface becomes covered with a thin film of oxide which almost completely prevents further oxidation. Although the surface film of aluminum oxide which forms gives considerable protection against further oxidation, particularly in the case of massive pieces, small particles of aluminum, e.g., powder and foil, are gradually converted entirely to aluminum oxide on sufficient exposure at moderately high temperatures to an oxidizing atmosphere. While aluminum oxidizes at all temperatures, the rate of oxidation is rapid above the melting point and especially above 725° C. Most smelting operations are carried out considerably above this temperature. A skin of aluminum oxide forms immediately on freshly exposed surfaces of liquid metal. In secondary smelting, oxidation should be avoided not only because of the effect on recovery but also to lessen the amount of suspended alumina in the melt which has an injurious effect on the properties of the metal.

Fine aluminum powder or very thin foil burns in the air on ignition with great violence. The thermit reduction of metallic oxides is based upon the high affinity of aluminum for oxygen. Thus, when aluminum powder is mixed with a finely divided metallic oxide and the mixture ignited, the reaction takes place with violence, yielding aluminum oxide and the metal of the metallic oxide reduced, e.g.,

$$Fe_2O_3 + 2Al = Al_2O_3 + 2Fe.$$

The molecular heat of formation of aluminum oxide, $Al_2O_3$, is about 386,000 cal. or about 128,700 cal. per gm.-atom. Some uncertainty exists as to the actual final end product of the oxidation of aluminum, but for the purposes of the present article the question need not be discussed fully. When aluminum combines with oxygen, the end product is generally considered to be the oxide $Al_2O_3$, formed according to

$$2Al + 3\ O = Al_2O_3.$$

In ordinary air, the oxidation of aluminum may be regarded rather more as an hydration of the metal taking place simultaneously with oxidation, since in the presence of water the reaction

$$Al + 3H_2O = Al(OH)_3 + 3H$$

goes on, and a colloidal film of aluminum hydroxide is formed. Borings and drosses for smelting should not be allowed to become damp in order to avoid the formation of this film which inhibits coalescence. Wet borings are, of course, dried for smelting.

Aluminum rapidly oxidizes if the surface is rubbed with mercury, an arborescent growth of oxide forming quickly on the metal. This phenomenon has been described by a number of workers, including Le Bon[2] and Jourdain[3]. McClendon[4] points out that aluminum will burn rapidly in air if a trace of mercury is driven into it by an electric spark. Under this condition, or when aluminum is rubbed with mercury, an aluminum oxide forms very rapidly and can be seen to grow with considerable speed. Thus, a coating of aluminum oxide as

* Parts 1, 2, 3, and 4 were published in our issues of January, 1925, September, 1925, February, 1926, and May, 1926, respectively.

[1] Y. Utida and M. Saito, The oxidation of metals and alloys at high temperatures, Sci. Repts. of the Tôhoku Imper. Univ., vol. 13, 1925, pp. 391-399.

[2] G. Le Bon, Modification de propriétés chemiques de quelques corps simples par addition de trés proportions de substances étrangerés, Compt. Rend., vol. 131, 1900, pp. 706-708.

[3] P.-R. Jourdain, Sur l'alumine provenant de l'oxydation à l'air de l'amalgame d'aluminium, Compt. Rend., vol. 150, 1910, pp. 391-394.

[4] J. P. McClendon, Acceleration of oxidation of aluminum by means of mercury, Univ. of Minn. Biochem. Bull. No. 4, 1915, p. 96.

thick as ¼-inch can be developed in a few minutes under suitable conditions. The rate of oxidation of aluminum is dependent upon the following specific conditions among others: (1) temperature; (2) time of exposure; (3) size and shape of particles, i.e., surface area exposed with relation to weight; and (4) constitution of the atmosphere to which exposed. In general, the usual aluminum alloys appear to oxidize more readily on melting than does the substantially pure metal, and there are noticeable differences in the oxidation rates of different alloys. The more finely divided aluminum is, the greater is the protective action of the aluminum-oxide coating on the separate pieces, since Zappi has found that large pieces of metallic aluminum react with carbon tetrachloride at 100° C. whereas aluminum powder does not react at 280° C.

There is considerable evidence in the literature and elsewhere that aluminum oxides other than the sesquioxide, $Al_2O_3$, may exist. The existence of certain suboxides of aluminum has been suspected by a number of investigators as far back as 1890. Thus Pionchon[5] came to the conclusion that the final end product of the direct oxidation of aluminum was $Al_2O.3Al_2O_3$, indicating the existence of the suboxide $Al_2O$. Duboin[6] states that aluminum combines with oxygen with incandescence, giving the oxide $Al_2O$ of Pionchon. Later, Kohn-Abrest[7] examined the influence of temperature upon the oxidation of aluminum and concluded that AlO was the final product of oxidation. In addition to the oxides $Al_2O$ and AlO, others corresponding to the formulae $Al_4O_3$, $Al_3O_4$, and $Al_6O_7$ have been suggested. More recently, Kohn-Abrest[8] has described the spontaneous oxidation of aluminum in air. According to this investigator, when substantially pure aluminum is heated *in vacuo* it begins to distill at 1,100° C., in the absence of silicon and carbon; at this temperature, the time required for distillation is 73 hours. At 1,200° C., distillation is complete in 30 hours. It is stated that part of the metal is less volatile than the rest, and a portion is isolated which is oxidized spontaneously on admission of air.

Rhodin[9] has shown that when aluminum powder is heated in air at 700° to 800° C. a constant hourly increment is found on weighing, owing to the oxidation of the metal particles to an aluminum oxide. Rhodin submits that substantially pure aluminum burns in air to form the oxide $Al_3O_4$ just as iron burns to form $Fe_3O_4$. It is also stated by Rhodin that $Al_3O_4$ is soluble in aluminum and that the apparent $Al_2O$ of Pionchon and Duboin is simply a solid solution of $Al_3O_4$ in aluminum. Investigation just recently completed in England indicates that the oxide $Al_2O_3$ is not soluble in aluminum. The density of solid aluminum oxide ($Al_2O_3$) is about 4.0 as against 2.37 for aluminum at 700° C. The melting point of this oxide is 2,020° C. Aluminum oxide cannot be reduced to metal by carbon in an ordinary smelting operation.

### NITRIDATION OF ALUMINUM

Nitrogen combines directly with alumium at moderate temperatures to form aluminum nitride, and the fact that aluminum drosses contain aluminum nitride is well known. Richards found that when the dross and skimmings from melted aluminum were treated with water while still warm the dross gave off an odor of ammonia. The explanation given was that part of the hot aluminum in the skimmings oxidized to $Al_2O_3$, and that the high temperature thus produced caused some of the metal to unite also with the nitrogen of the air to form aluminum nitride. Several investigators have found that if aluminum powder is heated in a current of nitrogen at a temperature of about 700° C., aluminum nitride is formed with evolution of heat. Tschischewski[10] states that the reaction between aluminum and nitrogen begins at about 400° C., and its velocity gradually increases up to 1,350° C. In the presence of moisture, aluminum nitride gives rise to aluminum oxide and ammonia, according to

$$2AlN + 3H_2O = Al_2O_3 + 2NH_3.$$

A nitrogen content corresponding to about 15 per cent aluminum nitride has been found in the dross taken off in the remelting of skimmings. When aluminum nitride is formed on small particles of aluminum or alloy scraps in smelting, it coats the resultant globules and hence hinders coalescence.

### COALESCENCE OF LIQUID ALUMINUM GLOBULES

When globules of liquid aluminum are formed on melting borings, dross, or other scrap containing small particles of metal, they are reluctant to unite into a single mass of metal but remain as separate drops. The failure of globules to unite is due to a thin film of oxide, or oxide mixed with nitride (or possibly aluminum carbide) or with fine dirt. Gillett and James[11] point out that if a mass of coated globules be pictured, such a mass would reveal a honeycomb structure, wherein the drops of metal would be the honey and the film of aluminum oxide and dirt would be the comb. Expressed in another way, there is an emulsion of a solid (the coating film) and a liquid (the metal). On smelting fine scraps, if this emulsion is not broken up entirely and the separate particles set free from the enclosing coating, then the whole mass of aluminum oxide and dirt together with the enclosed metal will be removed on skimming. When air comes in contact with such a hot porous mass, as it will when dross is skimmed, the minute liquid globules entangled in the mass oxidize rapidly. The heat of reaction is so great that a layer of such dross a few inches thick placed on an iron plate ¼-inch thick will burn a hole rapidly through the plate.

Of course, fairly large borings free from dirt form fairly large globules on melting, and such globules can break through the enclosing film of aluminum oxide by their own weight. Hence, they will coalesce fairly readily and melt down without much loss. In the case of fine borings, e.g., those that will pass a 20-mesh screen and that may have a thickness of only 0.005 inch or less, the situation is different. These small chips and borings form globules of almost microscopic size, and their weight is insufficient to rupture the enclosing film of aluminum oxide much less a heavy coating of dirt. Consideration of the phenomenon of coalescence shows why clean large borings give good recovery on smelting, small and dirty borings give much lower recovery, and the least recovery is had with grindings. The failure of coated aluminum globules to coalesce is similar to the behavior of floured or sickened mercury, and close analogy is had with the blue powder obtained in zinc smelting which can be melted only with difficulty. In calorizing iron or steel parts, i.e., coating with a film of aluminum, the pieces to be coated are packed in a mixture of aluminum powder and aluminum oxide and then heated to about 900° C.—

[5] M Pionchon, Sur un produit l'oxydation incomplète de l'aluminium, Compt. Rend., vol. 117, 1893, pp. 328-330.

[6] A. Duboin, Sur les propriétés reductrices du magnésium et de l'aluminium, Compt. Rend., vol. 132, 1901, pp. 826-828.

[7] E. Kohn-Abrest, Sur la poudre d'aluminium et l'oxydation de l'aluminium, Bull. Soc. Chim. France, vol. 86, 1904, pp. 232-239; and Sur differents états d'oxydation de la poudre d'aluminium, Compt. Rend., vol. 141, 1905, pp. 323-324.

[8] E. Kohn-Abrest, Sur l'aluminium spontanément oxydable à l'air, Compt. Rend., vol. 169, 1919, pp. 1,393-1,395.

[9] J. G. A. Rhodin, Contributions to the chemistry of aluminum and aluminum alloys, Trans, Faraday Soc., vol. 14, 1919, pp. 134-149.

[10] N. Tschischewski, The occurence and influence of nitrogen on iron and steel, Jour. Iron and Steel Inst., vol. 92, No. 2, 1915, pp. 47-97.

[11] H. W. Gillett and G. M. James, Melting aluminum chips, U. S. Bur. of Mines Bull. 108, Aug. 1916.

far above the melting point of aluminum. The small particles of the aluminum powder do not coalesce, however, since they are prevented from doing so even in rotating calorizing furnaces by the aluminum oxide. In actual practice, the coalescence of liquid aluminum globules is forced mechanically (by poking or puddling) or by the use of a flux which dissolves the film or oxide or dirt from the metal drops. A film of oxide on a globule of metal forms a semi-rigid structure, and the actual surface tension of the metal is less than if the oxide were not present. The effect of a suitable flux is to dissolve the oxide thereby causing greater fluidity.

### PREVENTION OF OXIDATION ON SMELTING

As already indicated, the prevention of oxidation is one of the most important problems in smelting practice. Various recovery methods have been suggested which have for their main object the prevention of oxidation. These include the following: (1) The use of a flux, or more precisely a liquid (molten) flux cover, which melts at or below the melting point of the aluminum or alloy to be smelted, so as to prevent contact of the metal with air; (2) the use of a chemical flux which will dissolve oxide and dirt thereby reducing further oxidation; (3) the exclusion of air from light scrap, like borings, by puddling the scrap into a liquid heel of metal; (4) the exclusion of air by using a vacuum or retort furnace, or using the stored heat in the walls of a previously heated furnace; (5) briquetting borings before smelting so as to press the small pieces closely together thus making coalescence easy, reducing the amount of air introduced into the furnace, and permit easy submersion of the borings under the surface of a liquid heel; (6) baling light scrap to reduce the surface area exposed (and otherwise for the same reasons as briquetting); (7) subjecting a mass of borings to pressure while melting to promote coalescence or subjecting to both slight pressure and constant stirring as in the puddling method; and (8) promoting coalescence by the use of a volatile flux (for the same reason as using a chemical flux, i.e., the detachment of oxide and dirt films).

In practice, particularly when working large batches in reverberatory practice, it is usual to employ a liquid flux cover to prevent contact of the hot furnace gases with the metal charged. Thus, a liquid heel will be prepared in the furnace and this covered with a layer of flux. After melting, the flux forms a blanket over the metal, and borings or other light scrap are charged and rabbled through the blanket and into the heel, contact with air being prevented so far as possible. Such a fluxing cover will usually be of such composition that it will dissolve aluminum oxide. In the puddling method of smelting borings, oxidation is largely prevented by working the small pieces rapidly into a liquid heel, the mechanical work of puddling breaking the film of oxide on the individual chips and forcing coalescence. This is usually assisted by the aid of a flux. Vacuum or retort furnaces have not proved successful in aluminum work. The idea of briquetting borings appears to be good from the metallurgical point of view. Some success has been had with this method abroad but it has been used only slightly in the United States. Baling is common practice in this country in handling light sheet scrap and clippings. Light clippings are difficult to handle unless baled, and it is difficult to poke clippings down under a liquid heel. Hard compact bales which are readily submerged in a bath of metal are easily made on the modern types of scrap baling machines. The process calling for the use of gas pressure in promoting coalescence has not been employed in practice.

When using open-flame furnaces for running scraps, particularly borings, it is advisable to employ liquid flux covers for preventing oxidation. Although the atmosphere of such furnaces can be controlled fairly well so as to give non-oxidizing conditions, the doors must be open so much of the time for charging and rabbling that sufficient air enters to set up a strongly oxidizing atmosphere. As explained in a previous article, fluxes used in secondary aluminum smelting are of three kinds, viz., (1) those employed mainly as covers to reduce oxidation losses, like sodium chloride and certain mixtures of sodium chloride with other salts; (2) those which actually dissolve aluminum oxide and dirt and hence induce coalescence of liquid globules of metal, i.e., the fluoride fluxes; and (3) those which have a mechanical action, serve to remove foreign suspended matter, and assist in detaching metal from oxide, e.g., zinc chloride. A flux for smelting drosses, borings, and light loose scrap having a tendency to oxidize rapidly should preferably have the power of dissolving aluminum oxide, induce the coalescence of particles, and have melting point of under 700° C. Any harmful effects of oxidation on smelting can be largely overcome by treatment of the melt with suitable fluxes which will dissolve and remove suspended alumina.

The sixth article in this series will deal with the preliminary treatment and preparation of aluminum and aluminum-alloy scraps for smelting.

# Aluminum—Silicon Castings

**Written for The Metal Industry by JESSE L. JONES, Metallurgical Editor**

Ordinary sand castings made of aluminum-silicon alloys running about 2 to 5 per cent silicon, have been found quite unreliable for fittings and pressure castings. Die castings leave much to be desired. Permanent mold castings, however, have been tested up to 3,000 pounds water pressure and found satisfactory.

It has been found desirable to cast all permanent mold articles as far as possible in a vertical position, on account of the necessity of allowing opportunity for gases and entrained air to escape. Flat gates are used in order that the molds may be poured as quickly as possible. A gate in the shape of a cross has been found useful on occasions.

While the mixture named above is all right for pressure work, it might be modified by adding a small amount of sodium, which gives a finer grain to the alloy. The rich-silicon alloy used for mixture should not contain over 20 per cent of silicon and the iron content should be kept under 0.6 per cent. If iron pots are used for melting, considerable care should be exercised to avoid overheating and the contamination of the alloy by large amounts of iron.

# Grinding

## A Precision Method for Quantity Production *

"Grinding," like many another English word has more than one signification. To the miller it means making flour of grain. To power and metallurgical engineers it means reducing coal or ore to powder as a step in a process. To machinists it meant not so many years ago giving metal parts a refined finish by removing a little surface metal with a small thin abrasive wheel in a light machine.

In 1886, Charles H. Norton, born at Plainville, Connecticut, in 1851, began putting a new meaning into "grinding." Progress was slow. In 1895, Niagara, harnessed, began to supply electric current in unprecedented quantity at low price. About this time, Charles B. Jacobs invented a new abrasive, known by the trademark "Alundum." Soon Aldus C. Higgins followed with the water-cooled electric furnace for producing alundum abrasive in quantity, in the works of a company bearing the name of a Norton of another tribe. Norton, C. H., now had a strong, effective cutting medium for his grinding machines.

Norton was trained at the Seth Thomas Clock Works in making machines for indicating the passage of time. He was impressed deeply with the value and never failing exactness of time. Later, he noted the great amount of time and highly paid labor then required for precision grinding. Realizing more and more the usefulness of precision grinding in modern machine production, he set out to reduce its cost. About that time, new special steels were making feasible very deep cuts with metal-working tools and were absorbing interest generally. Norton, however, appears to have been first to perceive that the electric furnace abrasive wheel, mounted in a heavy machine, might remove metal in small particles as rapidly as the special-steel cutting tools. This conception started him on his experimentation.

At first, "practical" machinists thought Norton's ideas very impractical. Fortunately, however, there were enough courage and money to back his investigations and demonstrations. During the past two decades a remarkable evolution has been wrought, a new mechanical process has been brought into wide use.

Twenty-five years ago the grinding machine was a light, low-powered tool, polishing surfaces and occasionally doing accurate sizing to a limit of one-thousandth of an inch, at great cost. Today, a heavy, high-powered production tool with a precision of one four-thousandth of an inch in commercial manufacturing, it has become a big factor in low-cost and high-rate production of automobiles, locomotives, machine tools, cash registers, linotypes, monotypes, adding machines, typewriers, agricultural machinery, machine tools, armament and many other metal objects.

Norton's fundamental idea was that a modern abrasive wheel set in a sturdy machine and driven by a lot of power could cut metal rapidly, accurately and cheaply in spite of high first cost for equipment. Old grinding machines used a fraction of a horse-power. He proposed applying at least 15 horse-power in each machine. The old wheels removed about one-sixteenth of a cubic inch of metal per minute. Grinding machines now remove from two to six cubic inches and in rare operations as much as twelve cubic inches each minute. Frequently, when cutting as much as three to four cubic inches of metal in a minute, grinding machines leave the work sufficiently accurate and well finished to need no further refinement. From being a method of securing refinement at great cost, grinding has become one of the cheapest methods of production for cylindrical objects of metal with finished surfaces. Flat surfaces also can be produced very accurately.

Novel features were introduced for getting great accuracy without the highly skilled machinist. Mechanics of ordinary training can obtain the desired results. Modern quantity production demands interchangeability of parts. Each part must be made so accurately as to size and shape that any of them can be used without selection in putting the mechanisms together. The new grinding machines made it possible to secure exact size on repetitive work in unlimited quantities.

The old conception of precision and delicate adjustment was embodied in light, small, beautifully made mechanisms. Norton made massive machines with heavy operating parts capable of being moved a distance so small that a line of that width could not be seen with the naked eye. That the movement can be made repeatedly with absolute dependability has often been proved by making four adjustments of twenty-five one-hundred-thousandths of an inch, always arriving exactly on the test line.

By combining massiveness and large power with great precision and utilizing the superior new abrasives, Norton developed a new art of cutting metal which has contributed largely to present-day economy and efficiency of many machines in daily use on farm, highway and railroad, and in factory, office and home.

*Contributed on request to **Research Narratives** by Aldus C. Higgins, Member, American Society of Mechanical Engineers; Treasurer, Norton Company, Worcester, Massachusetts.

## Strong Aluminum Bronzes

A strong aluminum bronze composed of 82¼ lbs. copper and 8¼ lbs. alloy containing 57% copper, 20% nickel, 20% iron, and 3% aluminum-manganese (75 Al—25 Mn), to which when melted together and at a good heat there are added 7½ pounds pure aluminum, has the following physical properties:

Ultimate tensile strength—82,000 pounds per sq. inch.
Yield point—41,000 pounds per sq. inch
Elongation in 2 inches—30 per cent
Brinell Hardness—171.

It is to be understood that the alloy of copper, nickel, iron and aluminum manganese is first made and then poured into ingots. Then the stated quantity as set forth is melted with the copper. This alloy can be recommended for castings where toughness and strength are required, and is highly resistant to corrosion, salt water and sulphite liquors. Its properties compare closely with Swedish Bessemer steel.

Another aluminum bronze with good physical properties is as follows: Copper 86 pounds, iron 4 pounds, aluminum manganese (75 Al—25 Mn) 3 pounds, pure aluminum 7 pounds. It has the following properties:

Ultimate tensile.....77,600 pounds per sq. inch
Elongation............35 per cent in 2 inches
Elastic limit........35,000 pounds per sq. inch

In making this alloy first melt the copper good and hot and then add the iron in the form of tin plate, loosely rolled. At the same time stir well but do not attempt to jam it down. Then add the aluminum, including the aluminum manganese (75 Al—25 Mn) and at the same time, stirring well and the heat raised by the aluminum will rapidly melt the iron.—E. D. GLEASON.

# Electro-Sherardizing

## A Serial Report of the Power Committee (1925-1926), Commercial National Section, National Electric Light Association

Every manufacturer, in whatever line of industry, has to contend directly or indirectly with the problem of rust. If not directly with this product, then indirectly with the machinery and tools he employs.

It is estimated that 25 per cent of the amount of iron produced yearly is destroyed by rust. As it requires from three to four pounds of coal to produce one pound of steel, it will be readily seen that the process of rusting is a costly one.

In order to prevent rusting of iron various processes have been introduced, among which is sherardizing.

Electro-sherardizing consists of covering the iron or steel with a protective coating by revolving the material in drums in a zinc dust preparation maintained at a temperature of approximately 700°-750°F. by means of electric heat.

### EQUIPMENT

The equipment consists of an electrically heated oven or furnace, inside of which is placed a cylindrical drum or container holding the material to be sherardized and the zinc dust, and automatic control panel with temperature control and a thermocouple projecting through the inside of the furnace. The drum rotates on four rollers mounted on two shafts which are driven by a small motor through a speed-reduction mechanism. The oven or furnace should be well insulated and the top, which serves as a cover, is sealed by means of sand. The heating elements are arranged to give equal distribution of heat throughout the furnace, thus insuring a uniform coating on all material. In order to obtain maximum production it is desirable to have a spare drum which can be packed while the other drum is in operation.

### CLEANING THE MATERIAL

The material that is to be sherardized must have a clean surface, free from scale, rust spots, oils, etc. The cleaning can be accomplished preferably by sand blasting or shot blasting. Where the material to be sherardized is in the form of bolts and nuts, where it is impossible to sand or shot blast, or when a smooth surface is desired, pickling is employed. When it is necessary to pickle, the material must first be washed in oxide of potassium. For a 500-gallon tub, 50 pounds of oxide of potassium should be dissolved in 500 gallons of boiling water. After the materials have been placed in the tub, it should be continually agitated until all greases are removed. The material should be rinsed in cold water and transferred to the pickling tub. The pickling solution consists of one part sulphuric acid to twelve parts of water. When making up the acid solution, the acid should be added slowly to the water to prevent any mishap that might result from the chemical change that takes place. If a very smooth finish is desired, the pickling solution should consist of 1 gallon of sulphuric acid, 30 gallons of water and ½ gallon of muriatic acid. In mixing this solution the sulphuric acid should be slowly poured into the cold water and the muriatic acid added last. After removing the material from the pickling tub it should be washed thoroughly first in cold water and then in boiling water to remove all traces of acid.

### ZINC DUST PREPARATION

The zinc dust preparation as furnished by one large manufacturer has the following analysis:

| | | |
|---|---|---|
| $SiO_2$ (Silicon Dioxide) | 0.01% | |
| Sn. & Cu. (Tin & Copper) | 0.05% | |
| Pb (Lead) | 0.39% | |
| Fe (Iron) | 0.56% | |
| ZnO (Zinc Oxide) | 5.64% | Zinc 98.82% |
| Metallic Zinc | 93.18% | |

When starting the sherardizing process for the first time, the zinc dust preparation alone is available. Before good sherardizing results can be obtained it is necessary to run several heats, using scrap material so as to pulverize the zinc dust preparation to a proper consistency until it shows a dark color. After four or five runs have been made, an analysis of the dust should show a percentage of metallic zinc from 85 per cent to 90 per cent and a percentage of zinc oxide from 8 per cent to 10 per cent. The lead content should not be permitted to be over 1½ per cent, for it has a low melting point and deposits on the surface in lumps, resulting in poor appearance, and may clog the threads of the material to be sherardized. By adding a quantity of the original zinc dust it is possible to lower the percentage of lead content. The iron content of the dust should not be allowed to go over 2 per cent because of its corrosive action. In order to minimize the amount of iron, the dust should be run through a magnetic separator at least once every two weeks and should be sifted through a 60/1 riddle. It is recommended that a weekly analysis of the iron content in the dust be made. The best results will be obtained if the percentages are kept within the following limits:

| | |
|---|---|
| Zn (Zinc) | Between 85 and 90% |
| ZnO (Zinc Oxide) | Between 8 and 10% |
| Pb (Lead) | Between 1 and 1.5% |
| Fe (Iron) | Between 1 and 2% |
| Other impurities | Between 0.5 and 1% |

### PACKING THE DRUM

For an average 2,000 pounds of miscellaneous material, such as rough bolts, nuts and small pieces, approximately 400 pounds of zinc dust should be used. The first run should be made with 400 pounds of new zinc dust preparation, the next with 380 pounds of the dust removed from the first run and 20 pounds of the new zinc dust preparation, making 400 pounds in all. This procedure should be followed for about ten heats, when the proportion of the old to the new dust should be 360 pounds of old dust to 40 pounds of new dust. This proportion should be maintained for each heat thereafter, although the percentage of new dust may be reduced somewhat, providing the chemical analysis of the dust holds up to standard.

When the material to be sherardized consists of long or flat pieces which will weigh 2,000 pounds, the dust should be increased to 540 pounds of old dust and 60 pounds of new dust, and should be placed between the layers of the material, so that it will more easily come in contact with the whole length of the material and thereby insure a complete sherardizing of all the surface.

With cup-shape punchings and castings it is necessary to increase the amount of dust even more.

The material should be packed in the drum in such a way that it will have room to roll or tumble, so that all parts can move separately, thus allowing the dust to come in contact with the entire surface of the material.

To obtain the best results, the drums should not be packed any higher than 8 inches from the top, but if the load consists of thin, long pieces it could be packed tight.

In order to sherardize large and small pieces at the same time, the small pieces and zinc dust may be packed in a separate container and placed in the drum, together with the large pieces to be sherardized. This also applies to small quantities of material that are to be buffed.

OPERATION OF THE EQUIPMENT

The drum is placed on the rollers of the furnace so that the rail at the motor end rests between the flanges on the rollers. The motor should be started to ascertain that the drum rotates in the correct direction. Sufficient sand should be used to provide a good seal for the cover. The temperature control instrument should be set for the proper temperature to be found by trial, which will be between 700° and 750°F. The material should be brought up to temperature and maintained at that temperature for 3½ to 4 hours. The total time of the run will vary, depending upon the weight of the material, at the most about 5 hours. After the temperature run, the cover should be opened and the drum allowed to rotate until it cools down to about 300 deg. cent. The drum can then be removed from the furnace and allowed to cool to below 200 deg. cent., when it may be emptied. Oftentimes a cooling rack is used, which consists of a set of rotating rollers similar to those in the furnace, on which the drum may be rotating while cooling. With this arrangement, time may be saved. When one drum is removed from the furnace another loaded drum can replace it.

THE FINISHED PRODUCT

The thickness of the deposit to give the best protection is .0025 inches. This thickness is considered the standard, and where threaded parts are to be sherardized they may be undercut or overcut, as the case may be, to allow for this deposit.

In case of sherardized parts containing holes and pieces fitting into these holes, the allowance for sherardizing is made in the holes. In other words, the hole is made 0.010 inches larger. This increase of deposits is equivalent to 0.85 to 1.1 ounce per square foot.

This thickness of deposit can be determined by weighing samples before and after sherardizing.

Two finishes may be obtained in sherardizing, plain and polished. The polished finish, giving an appearance similar to nickel, is obtained by buffing the material before and after sherardizing. The plain finish is obtained by sherardizing without buffing.

TESTING THE FINISHED PRODUCT

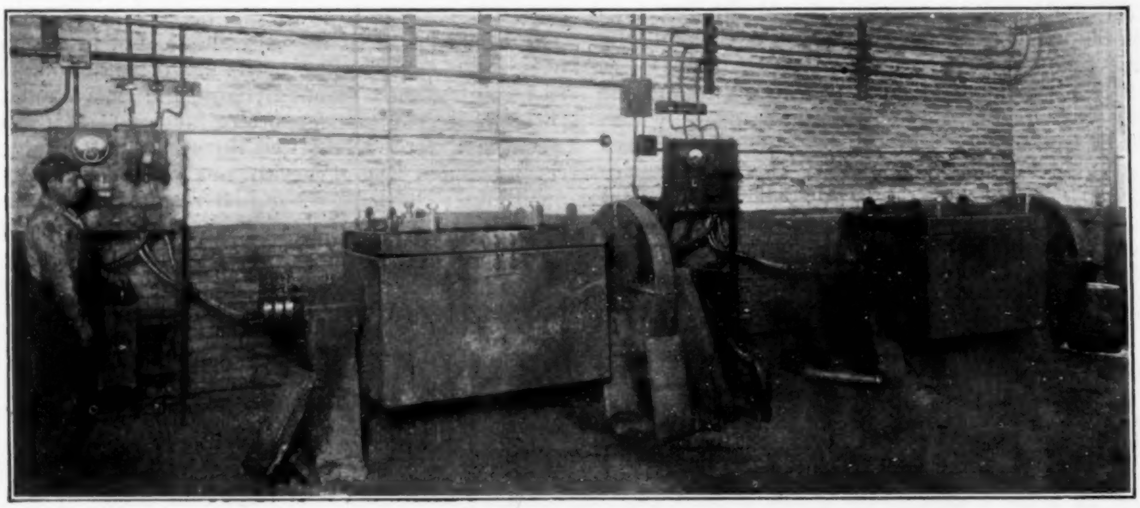
The finished product can be tested for quality of the coating by the salt spray test. The samples to be tested are sprayed with a salt-water solution of approximately 1.026 to 1.030 gravity at 60 deg. fahr., using compressed air to project the spray. A good coating will show a thin film of moisture with very few if any drops of palpable size appearing on the surface. Any pin holes or uncovered surface will show up very readily.

CARE OF EQUIPMENT

At all times care should be taken in placing the cover on the drum to see that the gasket is in place and all clamping bolts well tightened to prevent the dust from leaking into the furnace chamber. Once a week the inside of furnace should be blown out with an air hose to prevent the accumulation of a sufficient amount of dust on the insulators to cause a short circuit.

No oil whatever should be used on the main bearings, as it quickly carbonizes and causes trouble. The bearings are lubricated with graphite rods embedded in the bearings.

The worm gear and motor should, of course, be lubricated the same as on any other machine.



ELECTRO-SHERARDIZING MISCELLANEOUS AUTOMOBILE PARTS

## Data on Electro-Sherardizing

INSTALLATION A

**Plant** ................Steere Engineering Company—Owosso, Michigan.

**Product** ..............Tanks, cooling coils, etc.

**Work done** ...........Electro-sherardized pipe-fittings, bolts, nuts, plugs.

**Equipment** ..........1 electric heating furnace.

**Size** ...................27 ft. long x 4 ft. 6 in. wide x 3ft. 6 in. deep, 147 kw., 440 volts, three phase.

**Temperature** .........780 deg. fahr. for 4½ hours.

**Time** ...................5¾ hours, of which 5½ hours is required for heat and ¼ hour for changing drum.

**Load** ...................Maximum load 5 tons, including both material and dust. Average load 2000 lb. material per charge.

**Pounds per Kw-hr**....5.65 including heating up.

**Previous Heating Process** ...................None.

| | |
|---|---|
| **Cost of Operating Compared with Previous Heating Method** | None. |
| **Reason Why Installed** | Offers a most compact heating arrangement, quick heating and accurate control of temperature within narrow limits. |
| **Opinion of Installation from User's Standpoint** | Entirely satisfactory. |
| **Opinion of Installation from Central Station Standpoint** | Excellent. By operating this furnace from 7:00 P. M. to 7:00 A. M. customer obtains very attractive rate and utility obtains another twenty-four hours consumer. |
| **Source of Data** | Steere Engineering Company and Consumers Power Company. |

INSTALLATION B

| | |
|---|---|
| **Product** | Automobile parts, bolts, nuts, screws, etc. |
| **Work Done** | Electro-Sherardizing of small parts, such as bolts, nuts, screws, etc. |
| **Equipment** | One electric heating furnace. |
| **Size** | 60 in. long by 39 in. wide by 36 in. deep, 45 kw., 440 volts, 3 phase, 60 cycle. Two drums used—48 in. diameter by 26 in. deep. |
| **Temperature** | 675° F. to 705° F. |
| **Time** | 6 hour cycle. |
| **Load** | Maximum load 200 lbs. of material per charge (18,000 screws per charge.) |
| **Previous Heating Process** | None. |
| **Cost of Operating Compared with Previous Heating Method** | None. |
| **Reason Why Installed** | Contracts from various industries called for some means of rust-proofing. This process afforded compact heating arrangement, quick heating and accurate control of temperature within narrow limits. Work resulting fulfilled all requirements of the various specifications for rust-proofing. |
| **Opinion of Installation from User's Standpoint** | Entirely satisfactory. |
| **Opinion of Installation from Central Station Standpoint** | Primary customer using equipment on off peak load. This afforded cheap rust-proofing for the customer at reasonable revenue and desirable business for the utility. |
| **Source of Data** | Customer and Central Station. |

INSTALLATION C

(See Fig. 1)

| | |
|---|---|
| **Plant** | Wise industries, Detroit, Michigan. |
| **Product** | Miscellaneous automobile parts. |
| **Work Done** | Electro-Sheradizing miscellaneous automobile parts. |
| **Equipment** | 4-50 kw. drums. |
| **Size** | 60 in. long by 39 in. Wide by 36 in. deep, each. |
| **Temperature — Hand Control** | 350° C., 5° ± |
| **Time** | Cycle 12 hours.<br>3 hrs. high heat<br>4 hrs.—low<br>3 hrs.—cooling<br>2 hrs.—load and unload<br>for a load of material of 1000 lbs. |
| **Load** | 600-1100 lbs. |
| **Pounds per Kw-hr** | 5.5. |
| **Previous Heating Process** | Electric from start. |
| **Cost of Operating Compared with Previous Heating Method** | Has installed an oil fired unit made up of several drums to handle long lengths of pipe, and states that while fuel cost is less, the temperature control is not as satisfactory. |
| **Reason Why Installed.** | |
| **Opinion of Installation from User's Standpoint** | Very satisfactory. |
| **Opinion of Installation from Central Station Standpoint** | Very satisfactory. |
| **Source of Data** | Customer. |

# Segregating Brass Foundry Costs

## Standard Basic Departments for Uniform Cost Accounting—Recommended by the Cost Committee of the American Foundrymen's Association*

NAME OF DEPARTMENT

**No. 1. Melting.** The Melting Department includes the cost of all metals, fuels, repairs, supplies, and the conversion cost. The conversion cost includes labor and power beginning with the assembling of the melting stock and the fuel at the places of storage, and ends with the delivery of the molten metal into the ladles at the spout.

**No. 2. Molding.** The Molding Department includes the direct molding labor, the expense labor, repairs and supplies, beginning with the transportation of the molten metal from the spout, the pouring, the preparation of the molding sand, and ends with the delivery of the castings into the Cleaning Department.

**No. 3. Coremaking.** The Core Department includes the direct core making labor, the expense labor, repairs, supplies, and core materials, beginning with the mixing of core sand mixtures, and ends with the delivery of the finished cores to the Molding Department.

**No. 4. Cleaning.** The Cleaning Department and Shipping Department includes the direct labor and expense labor of tumbling, sand-blasting, grinding, gauging, inspecting, and the cost of repairs and supplies. This cost ends when castings are on trucks or cars for shipment.

**No. 5. General Expense.** The general expense includes all the items of cost and expense not enumerated in the above departments and not chargeable specifically to those departments. Such expenses are: general power, light and heat; general repairs not chargeable direct to the above departments; purchasing; production; accounting department; insurance; taxes; depreciation; loss on defective castings after shipment; general office expense; advertising; selling; loss on bad debts.

* From a chart shown at the Detroit meeting Sept. 27-Oct. 1, 1926.

## Effect of Oxygen Concentration on Corrosion of Copper by Non-oxidizing Acids

Corrosion of copper in pure non-oxidizing acids has long been known to be influenced markedly by the presence of dissolved oxygen. It now is found that in normal sulfuric and acetic acids corrosion is proportional to oxygen concentration. Corrosion in hydrochloric acid is roughly proportional to oxygen concentration, but is much greater than corrosion in the other two acids.—R. P. RUSSEL AND A. WHITE.*

* Abstract of a paper presented before the Division of Industrial and Engineering Chemistry at the Semi-Centennial Meeting of the American Chemical Society, Philadelphia, Pa., September 6-11, 1926.

# Fifty-Five Years of Plating

## A Review by a Veteran of the Growth of Electro Plating in a Large Manufacturing Plant*

By FRANK B. PARSONS

Formerly with the Scovill Manufacturing Company, Waterbury, Conn.

The first facilities for the electro-deposition of metal in the Scovill Company were installed about 1870. The plating room was situated about what is now the east end of building 41-A. The plating room in the west side, 25 x 25 feet; the japan room, east side, also 25 x 25 feet.

George W. Cooke was the plater and also the installer of the facilities. He was born in Waterbury, February 28, 1811; graduated from Yale College 1837; was a tutor at the Academy formerly on the site of the old City Hall, now the Steele building. He was one of the original stockholders of the "Waterbury American," and one of the organizers of the Mendelssohn Singing Society, 1853.

Mr. Cooke entered the employ of the Ames Sword Manufacturing Company at Chicopee, Mass., and was the first in the United States to successfully deposit gold and silver on steel, by the galvanic process. The first, also, to introduce the process in Waterbury. He opened a plating establishment, about 1865, on the site of St. John's Church Parish House. He was one of the founders (1869) of the newspaper known as the "Valley Index" 1870 he came to the Scovill Company to supervise plating, remaining until his death, 1897. Mr. Cooke was a substantial citizen of the old American type. It can be said that he was the father of plating in Waterbury.

The facilities for plating, in the seventies, consisted of one nickel tank of two hundred and fifty gallons; two silver, of twenty-five gallons each, one of gold, of fifteen gallons, and the necessary solutions of potash and cyanide.

The bulk of the work requiring nickel finish came from the Woolson Manufacturing Company, Watertown, and consisted of umbrella ferrules and fixtures.

Very little of the Scovill Company's manufactured output was plated before 1875. Military buttons of German silver, up to the middle seventies, were never plated, but were finished in the true metal color. About 1880 all German silver button orders were nickel coated. Solid buttons were given a roughing burnish with a bloodstone, subjected to a gold plate of twenty minutes, then given a finishing burnish. Door knob plates and escutcheon plates were silver plated for one hour, then burnished and wrapped in tissue paper before packing.

The batteries for generating the necessary current were fifteen jars of five gallons each of diluted sulphuric acid, containing a copper and zinc plate. The zinc sheets were previously scoured with sand and coated with mercury. This battery was in use until 1880.

About 1875 the construction of suitable generators gave a strong impulse to the plating industry, and a dynamo was purchased in 1880. It stood on iron standards three feet in height. The armature, commutator, and brushes occupied a space 6 inches x 30 inches. This supplanted the battery system, and made possible the larger production. Compared with the dynamos of the present day it was, of course, very crude. It was situated in the dip room of the old button department, near what is now the blanking room hallway, and was one hundred feet from the plating room; the generated current was carried through 30 gauge copper strips, twenty feet long by two inches wide, soldered end to end, run overhead on frame work. James Spruce, foreman of the button room at that time, supervised the installation.

About that time business increased in all departments; buttons with japan finish were in strong demand. More room was needed for japanning, so the plating room was moved to what is now building No. 5. Consequently supervision was transferred from the button department, under Lenthal S. Davis, to the burner department, Supt. John Lines (about 1885.) The employees were John Ferrell, who later became foreman of the press room (died, 1924); John Breen, now in the blanking room; George Beaucamp, Frank B. Parsons, retired; Henry Loveridge, retired; Charles Delarne, and Arthur Carey.

After the transfer, six nickel plating tanks were installed, a new dynamo added, for the nickel plate was coming into use as a finish for brass articles, such as match boxes, piano hinges, etc.

When Mr. Cooke died, he was succeeded by Mr. Smith, who retired 1895 on account of ill health. He was succeeded by Frank Davis (two years) and he by Wm. Snagg, whose service ended in 1903, by ill health. Mr. Snagg was succeeded by Thomas Colina.

Business continued to expand for nickel plated brass articles, and although plating tanks had been increased to twelve, the production did not meet the demand, so more room was needed. In 1906 the plating room was moved to building No. 48. Some of those employed were: Rollin Bird, Edward Meehan, P. Whalen, H. Granger.

Due to expansion of the button business, it became necessary to install their own facilities for plating (1902). Later, in 1904, mechanical electro-plating barrels were introduced, as it was seen that they would be a labor and time saving device, with which to meet competition. The first successful nickel, brass and copper plating by this means was done in the plating room of the button department. They were the forerunners of the numerous units now in use, and for small articles, such as eyelets, umbrella trimmings, and buttons, are indispensable.

Incidentally the water rolling-barrels were first introduced by the button department, and they, at one period, finished work such as cartridge shells and other articles for the entire plant. The first barrels were purchased in 1895. The button department continued to finish their products; which included dip and fire gilding, nickel and brass, copper and silver plating, and all dip bronzing coloring; they also supervised their own lacquering and continued to do so until the consolidation of all departments Septemmber 25, 1908, in building No. 48.

The dip and gilding button department employees (1908) were, among others, George Lee, Frank B. Parsons, Charles Maier, Joseph Long, H. N. Parsons, B. Serafino, Wm. Hubby, A. M. Parsons, J. Partree.

Thomas Colina died in 1912, and Edward Meehan succeeded him, holding the position for two years; then transferred to the rolling room. Albert M. Parsons was appointed foreman of the plating room. About this time the World War orders were placed, additional plating facilities were added. It was a strenuous period.

In 1919 Albert M. Parsons resigned, and was succeeded by Joseph McConas.

* From the Scovill Bulletin, September, 1926.

# Electro Deposition of Tin

## Practical Methods of Tin Plating

**From The Monthly Review, August, 1926**

**By WALTER FRAINE**

The early textbooks on plating contain considerable information regarding tin plating, either by simple immersion, by boiling, by boiling in contact with zinc or by contact with grain tin or block tin, which are electrolytic in their action, although not commonly so called.

References abound, as can be noted by turning to Roseleur, Elsner, Maistasse, Fearn, Birgham, Fields, Watt, Brandt, and so on down to our good friends and associates Blum and Hogaboom, of solutions suitable for these methods and some recommended as well as for heavier coatings.

For many years most of the tin depositing was done either by the immersion or the contact method largely because the work could be done at a very low cost and in considerable bulk. These two methods, used on small work where appearance and not wear was the chief consideration, gave satisfactory results.

When, however, it became necessary to provide thicker coatings to secure greater protection and wear, it became necessary to turn to the electrolytic method, with current from an outside source in order to secure these results. While heavy tin coatings can be easily and rapidly deposited by this method from solutions of various formula, great care must be taken to have all the conditions within proper limits to secure satisfactory deposits at low labor cost. The current density especially must be closely regulated to prevent spongy deposits and treeing. To prevent this, unless additional agents are used, it is necessary to remove the work from the solution frequently for scratch brushing to lay the grain of the metal and to keep the deposit even. This puts a labor cost on tin depositing which is, in many cases, out of proportion to its value to industry.

Out of the number of solutions suitable for heavy deposits of tin, in the writer's opinion there are three which, from the factors of ease of management, thickness of deposit secured, quality of deposit and low labor cost, are to be preferred. These are (1) the fluoborate or fluosilicate solution which is prepared by dissolving stannous chloride in caustic soda to form stannous hydroxide and to take up this precipitate with either of the desired acids—(2) the stannous chloride, sodium hydroxide solution mentioned by Blum and Hogaboom with this formula:

| | | |
|---|---|---|
| Stannous chloride ($Sn\ Cl_2$; $2\ H_2O$) | 4 | oz. per gal. |
| Sodium hydroxide ($Na\ O\ H$).... | 10 | " " " |
| Glucose (dextrose, $C_6$, $H_{12}$, $O_6$).. | 8 | " " " |
| Water ........................ | 1 | " |

and (3) the sodium stannate solution:

| | | |
|---|---|---|
| Sodium stannate ($Na_2\ Su\ O_3$).... | 24 | oz. per gal. |
| Stannous chloride ($Sn\ Cl_2$. $H_2\ O$) | ¼ | " " " |
| Rosin ........................ | 1/32 | " " " |
| Water ........................ | 1 | " |

The fluborate solution gives a fine thin dense deposit and requires scratch brushing to build up heavier deposits; its cost and greater difficulty of preparation reduces its popularity as compared with the alkaline solutions.

Both the stannous chloride and hydroxide solution and the sodium stannate stannous chloride solutions are capable of building up close grained, dense, impervious deposits, free from pin holes, to any thickness desired. Both solutions are long lived, constant in action, easy to control and remarkably free from sponginess or treeing at ordinary voltages.

The advantage, in our opinion, lies with the sodium stannate-chloride solution, in view of the fact that its period of usefulness is greater than the sodium hydroxide solution on account of the tendency of the hydroxide solution to accumulate sodium chloride which results in changing the color of the deposit from its original silver gray to a blue, and finally to a dark shade approaching black, which limits its usefulness. Both of these solutions deposit freely with a range of 140° to 180° Anodes:

Anodes used in the sodium stannate solution block tin and sheet steel, 90 per cent tin to 10 per cent steel. So far, it appears that the solution maintains itself from the anodes except for the amount carried out by the drag in removing the work. Replacements are made by adding sodium stannate in the original proportions and, if needed, muriate of tin:

Voltage: 5½ volts.
Amperes: 5 to 40 per sq. ft.

### THICKNESS OF DEPOSIT

As mentioned above, either of the two alkaline solutions will give close grained, dense, smooth deposits to any desired thickness without any scratch-brushing.

### THROWING POWER

One of the points in favor of the stannate solution is its great throwing power; angles, depressions, cavities, tubing, even cylinders as long as 16" × 5" × 2¼" are completely and evenly coated over the interior.

### ADDITIONAL AGENTS

Rosin dissolved in caustic soda ($NaOH$), 1/32 oz. per gallon when solution is used continuously.

Starch dissolved in water.

Glucose (dextrose, $C_6\ H_{12}\ O_6$).

### RESISTANCE TO CORROSION

with parts plated twenty minutes at five amperes per square foot, we may safely expect a minimum resistance to the action of the salt spray of 200 hours.

### CONTROL

Chemical: Blum and Hogaboom publish directions for analysis of tin solutions which are easily carried out. Samples of the solution are treated with hydrochloric acid and evaporated to expel the cyanides. The tin is then precipitated with hydrogen sulphide, and determined by ignition to stannic oxide, or by solution, reduction and titration with iodine solution.

### SUMMARY

The following is a summary of the qualities of the stannate chloride of tin solution which makes it exceptionally good for heavy deposits:

Simple formula,
Low cost to make,
Low cost for upkeep,
Deposits rapidly,
Gives smooth deposits to any desired thickness,
No sponginess or treeing,
Maintains natural silver gray color of deposit,
Good throwing power,
Easy to control,
Highly resistant to corrosion.

# Specifications

## What They Mean in Plating

**From The Monthly Review, August, 1926**

**By W. M. PHILLIPS**

Specifications—in the sense that they describe composition, physical properties, and behavior—are of greatest importance to the plater. Composition and physical properties are of importance only when they are known to influence the behavior of materials in use.

Specifications can be applied in two ways: One of them to the plater when the engineer puts on the blue print, "This piece must stand 48 hours' salt spray." The other use can be made by the plater when he says he will be glad to meet the specification, but that he would like to make some of his own affecting the plating and polishing equipment as well as the materials to be used.

The plater who swears a bit when he gets the specifications, is to be sympathized with; but respect is due the plater who decides that he will make his work much better than the specifications call for. In order to do this it is often necessary for him to make a very thorough study of his whole job and of the materials which enter into it. A great deal of emphasis has been put on the best plating formulas and methods in general. It is possible that in the next years we can make further advances by an examination of the materials we are using.

It is a well-known fact that small quantities of some materials have a tremendous effect on the quality of plating. We all remember Dr. Blum's paper on the effect of small additions of glue to nickel-plating solutions.

Only a few years back, the engineer wrote on parts drawings the short remark, "Nickel plate," which covered a multitude of sins and often not much nickel. He now puts on his drawings a specification covering a test on the nickel plating. In the old days, when he was so liberal, the plater was justified in ordering on his requisiton, "One barrel of nickel salts." Now, he does not only say whether he wants single or double salts, but may add one of the specifications of the Bureau of Standards; in fact—that is what we should have for every chemical used in the plating department, when and wherever it is practical to do it.

It would seem that every supplier of materials, who takes pride in his products, would welcome such a move on the part of the plater. It must be very discouraging to the man trying to sell a really good product to have to meet the competition offered by a dishonest manufacturer who loads up his material with cheap substitutes and offers it at a price to catch the unsuspecting purchasing agent.

Specifications, describing what the purchasing agent is supposed to buy, seem to be a logical solution for this difficulty. The work done by the Bureau of Standards has been very good, and what we need is more work of this kind, both by the bureau and by platers in general.

Two pictures come to my mind, and they—combined with George Hogaboom—were probably the cause of my writing this paper. Both happened within a short time of each other. After some years of work on a plating process, we were attempting to put it into production, and it did start off beautifully. So much so, that we decided on a much larger unit. Improved equipment was ordered and installed; solutions carefully made up; and finally, the day arrived to try it out. Officials of the organization were present, and the work put into the tank as usual. All the motions were gone through in apparently fine shape, but when the work was taken out, nothing had happened. It had no more plate on it than it had when it went in. It took two months of hard work to find out that one of our chemicals had contained impurities which made the operation of the bath impossible. The other instance is that of a plant which had spent years in obtaining a low price on Emery Cake—and they surely did succeed in this particular. They had the lowest price on record. But, when the "Emery Cake" was analyzed, it contained no Emery.

Now, please do not get the impression that it is practical to state the composition and physical properties of everything we use in the plating room, or that you could get any chemist to check up every article purchased.

The honesty and cooperation of the suppliers are of greatest importance, and by working together the plater and his supplier of materials can probably do as much in the next five years to improve the quality of plating, as has been done in the past five years. And, I believe that that is saying a lot.

## Detroit and the Open Shop

Shortly after the American Federation of Labor announced its intention of organizing unions in the automobile industries in Detroit, Mich., J. L. Dryden stated at a convention in New York of the National Association of Manufacturers, that Detroit's pre-eminence in automobile manufacture and its strong position in industry was due largely to the existence of the open shop. Mr. Dryden is the president of the Detroit Employers' Association.

He stated that at the present time Detroit had 700,000 workers of whom only 20,000 were working under closed shop conditions. This figure does not represent the total strength of organized labor in Detroit as there are many more than 20,000 members of unions. It does, however, represent the total number that are working in shops operated exclusively by union workers.

A number of years ago after numerous struggles, the Brass Manufacturers' Association and the Metal Trades and Founders' Association undertook to co-operate in putting Detroit on an open shop basis through the medium of the Detroit Employers' Association. Unions were not recognized and negotiations were carried on directly between the workers as individuals and the employers. In 1903 a free labor bureau was established, originally to replace strikers, which has since then placed almost 700,000 men in jobs.

## The Problem of the Crucible*

In this paper the author discusses the theoretical and practical factors governing the dimensions of crucibles or pots used for industrial fusions.

The subject is considered from the physico-chemical as well as from the economical standpoint. Mathematical equations of equilibria involved in the desired reactions are developed.—J. A. DEARTIGAS, Madrid, Spain.

* Abstract of a paper presented before the Division of Industrial and Engineering Chemistry at the Semi-Centennial Meeting of the American Chemical Society, Philadelphia, Pa., September 6-11, 1926.

# THE METAL INDUSTRY

With Which Are Incorporated

**THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER THE ELECTRO-PLATERS' REVIEW**

Member of Audit Bureau of Circulations and The Associated Business Papers

Published Monthly—Copyright 1926 by THE METAL INDUSTRY PUBLISHING COMPANY, Incorporated

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

SUBSCRIPTION PRICE, United States and Canada $1.00 Per Year. Other Countries $2.00 Per Year : : SINGLE COPIES, 10 CENTS
Please Remit by Check or Money Order; Cash Should Be Registered

ADVERTISING RATES ON APPLICATION. FORMS CLOSE THE FIRST OF THE MONTH

Palmer H. Langdon........................Editor and Publisher
Adolph Bregman..............................Managing Editor
Thomas A. Trumbour..........................Business Manager
Evan J. Robinson ..........................Advertising Manager

ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number: Beekman 0404. Cable Address: Metalustry

Vol. 24 New York, November, 1926 No. 11


## Contents



**Buyers' Guide—Advertising Page 77. Edition this month, 6,000 copies**

# EDITORIAL

## THE FUTURE FOR METALS

To everyone engaged in manufacturing or other kinds of business, there are certain primary factors of importance which must be recognized and coped with if the project is to succeed. Probably the most important single question is "Is the industry in which I am engaged growing or declining?" The inability to answer this question correctly has resulted in innumerable failures—among carriage builders, for example, who were almost wiped out by the automobile; and on the other hand, tremendous expansion for the oil companies who moved with the trend of the times by developing the production of cheap gasoline instead of sticking only to fuel oil. Movements of this sort which can be cited in considerable number make every thoughtful business man look carefully on his own industry.

The production and use of metals has had its ups and downs like every other industry. At one time there was much discussion as to whether the cheaper steel would replace all other metals. The tendency seemed to be all for high production and low cost, and steel seemed to be eminently suited to follow this step, while other metals, because of their comparative scarcity or difficulty of extraction, would be left behind.

The last few decades have definitely dispelled this fear. From the standpoint of cold figures, the statistics cited by Dr. Jeffries (abstracted in THE METAL INDUSTRY for October, 1926, page 422) show that the use of metals has risen faster than the use of iron and steel. In the period 1910-1914, 4.7 tons of non-ferrous metals were produced for every 100 tons of iron. In 1924, the proportion was 6.44 to 100. So much for abstract statistics.

During the last two months, a number of exhibitions held in New York have brought this situation forcibly to our attention. In several cases exhibitions with seemingly no direct relation to metals have nevertheless had to give the largest proportion of their space to metal products.

The Business Show featured equipment and supplies including adding machines, typewriters, calculating machines, check writers, and lighting fixtures, all of which find metals indispensable. Moreover, wherever steel or iron was used, it was plated or finished to protect it or beautify it, so that the plating and finishing trades were also involved.

The Radio Show almost eliminated iron and steel, except for some loud speaker bases, because of the electrical characteristics required in the receiving sets. As a result, brass and aluminum predominated.

The Industrial and Electrical show was a maze of aluminum, copper and brass, and wherever iron or steel was used it was almost always carefully covered with a bright or otherwise decorated finish.

An exhibition of the industries of Brooklyn, held by the Brooklyn Chamber of Commerce, showed foundry and machine shop products among the leaders and among these products, metals were most prominent.

Probably the most unusual leadership for metals was shown at the exhibition of the American Institute of the City of New York, in which brass and other non-ferrous alloys occupied most of the space of the show; Connecticut, the leading brass state of the United States being the most prominent exhibitor.

According to Dr. Bain, Secretary of the American Institute of Mining and Metallurgical Engineers, industry is consuming an ever-increasing quantity of such metals as zinc, copper and lead. It is obvious from its steady growth that aluminum is continuously on the upgrade. Nickel has made remarkable strides in the past five years and bids fair to take its place among these leaders.

As stated previously in these columns, it is now evident that quantity and low price cannot everywhere replace quality. Rust and corrosion must be combated because they are too costly, even though the material lost is comparatively cheap. Moreover, there has been a strong and growing tendency in recent years to demand attractive appearance. The advertising slogan "It is the Finish That Makes the Sale" has taken hold, not by mere reiteration, but because it expresses a natural and commendable desire of the consuming public to use attractive and artistic objects as well as utilitarian.

The problem in the metal industries is therefore, not one of loss of markets; it is rather the assurance of adequate supplies. Notes of warning have been sounded that our available resources of metals in the ground are being depleted; that the next generation will have to turn to other materials or radically change their standards of living. To us this seems very unlikely. The term "available supplies" is subject to many interpretations. We know that the earth's crust contains, for practical purposes, unlimited quantities of metal. Aluminum for example composes 8 per cent by weight of the accessible parts of the earth; iron 5 per cent; magnesium, more than either. Copper, lead and zinc are less plentiful but still present in enormous tonnages. At the present time only a small part of these enormous tonnages is "available" because our metallurgical reduction and refining processes are adapted, so far, only to certain types and grades of ore. The fear is then, that when these ores are used up, we shall be unable to get more metal.

This is greatly to be doubted. Long before our metals are used up we shall have ample warning of their growing scarcity. Scientific and technical effort will be devoted as fast as required to the extraction of metals from lower grade deposits or from such ores as are not now mined. When we consider that at the present time porphyries containing 1¼ per cent copper can be mined at a profit, whereas only a comparatively few years ago mine dumps and waste piles ran much higher in grade, it seems to us that future problems will be met when they become imminent.

The basic facts, then, about the metal industries seem to be that the demand for metals will steadily increase; that reserves, while they must decrease in quantity, should always remain enough for human consumption, so far as any such guess can be made, providing metallurgical science keeps step with the world's needs by devising methods of extracting the metals from different and lower grade ores. While we do not assume the position that all is well and nothing needs to be done, we do feel that the necessary results, difficult as they may seem at the present time, will be obtained.

## ALLOYS FOR CORROSION RESISTANCE

The problems of developing corrosion resistance in alloys has never been so clearly stated as by Dr. W. M. Guertler in his lecture at the Engineering Building, New York, October 27, 1926, before the Joint Meeting of the Institute of Metals Division and the American Society for Steel Treating. Briefly stated, the methods of producing a resistant alloy can be summarized as follows:

1. Start with a base of iron, nickel or copper as it is only these metals which will take up many others in solid solution to an appreciable extent; and solid solutions are necessary for corrosion resistance.
2. Use as addition agents those metals which will go into solid solution with iron, nickel or copper.
3. If other metals are added—namely, those which do not go into solid solution—the result will be perhaps the improvement of the mechanical or electrical properties, but not the chemical.
4. If addition agents are used, which do go into solid solution, then the resultant alloy will have some of the protective qualities of the added element, dependent in degree of course, upon the quantities added.

An excellent example of this is the use of chromium when added to iron or nickel; not copper of course, as chromium does not dissolve in copper.

5. To resist specific chemicals, find the metal which has that particular quality and add it to one in which it goes into solid solution. The resultant alloy has a chance of successfully resisting said acid.
6. If an alloy is attacked by a specific chemical, it may be that small additions of a metal, resistant to that chemical, added to the alloy, will form a protective coating which will enable the alloy to resist further attack—providing it will go into solid solution.
7. If an alloy is not attacked by a specific chemical it should be investigated further under different temperatures and different degrees of purity, as its properties may vary under varying conditions.
8. There is no everlasting stability of any metal or alloy; nor can any alloy be developed which will resist everything. Every mixture will have its peculiar properties, will be resistant to certain chemicals and corrodible by others.

We give the above summary without comment as it needs none. A careful study of these points will save many inexperienced (and perhaps some experienced), investigators from spending time, energy and money in blind alleys.

## THE INTERNATIONAL SILVER MARKET

The recent crash in the silver market leads us to make all sorts of interesting comparisons and perhaps to prove conclusively that it had to happen. In making such explanation it is necessary, however, to guard against "hindsight" and post mortem explanations.

For many years it has been known that the dominating factor in the price of silver was the Eastern demand, that is from India and China. This demand was based largely on coinage. India, for example, has been absorbing over ⅓ of the world's annual production of 240,000,000 ounces. If either of these Eastern users of silver for coinage had withdrawn at any time, the price would have dropped immediately, as the commercial use of silver was not sufficient to keep at the 60 to 65 cent level.

India has now finally established a gold-based currency and the result is felt in two ways. In the first place the Indian Government will not be a buyer of silver in the international market and it will also reduce its reserves, over a period of years, from 850,000,000 to 250,000,000 rupees; in other words, place upon the market 206,000,000 ounces of silver. In addition, silver which has been privately hoarded will also reappear in the open market. Although Government reserves will not be dumped at once, private silver which is estimated at about of 500,000,000 ounces may appear at any time and in any quantity.

The commercial use of silver is rising steadily and it is in this that the hope of silver producers will lie. The chances are that those mines operating with silver as the primary value will be the first to feel the decline. However, a large proportion of the silver produced is recovered as a by-product of copper and gold ores, and for that reason, although profits will of course be cut, the mines will not necessarily have to shut down.

One possibility that is open is for the silver producers to organize, co-operatively, a research bureau to develop new lines for the use of their metals. It is not a new idea as it has been tried in other lines, with conspicuous success in copper. But it would be decidedly in order for the silver producers to enter upon such a campaign actively. With adequate funds and management, such a course should, we believe, help to pull producers of this metal out of their difficulties.

## LEAD IN THE BRASS FOUNDRY

A letter on page 468 of this issue from Thomas Harper addressed to the Metropolitan Brass Founders' Association of New York brings up a question which has never been stated before. "Are high lead mixtures common in brass foundries?"

The New York State Rating Board has ruled that they are, and that consequently the brass foundries of New York State must all pay a higher compensation insurance rate due to the increased hazard in foundries casting highly leaded mixtures. Mr. Harper dissents from this opinion and his reasons are given in his letter.

In a general way of course, a brass foundry is a foundry which casts all metals outside of iron and steel. Consequently brass foundries cast aluminum, zinc and a large variety of bronzes. But the general name, "brass foundry," is applied to them, nevertheless. Until now any distinction would have been academic as there was no purpose in separating them. However, now that the question of insurance rates has arisen, it seems that there may be some reason for differentiation between types of brass foundries. Certainly the stand that the safer foundries should not pay the same rates as the more hazardous high lead foundries, cannot be passed by unnoticed. We should like to know the feelings of our readers on this question and whether a similar situation has arisen elsewhere.

## GOVERNMENT PUBLICATIONS

**Antimony Production in 1925.** Department of Commerce, Washington, D. C.

**Shovels, Spades and Scoops.** Simplified Practice Recommendation No. 48. Department of Commerce, Washington, D. C., obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. Price 5 cents.

# CORRESPONDENCE and DISCUSSION

**Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein**

## Are High Lead Mixtures Common to Brass Foundries?

The following is a letter from Thomas Harper of New York, brass founder, who is well known to readers of THE METAL INDUSTRY, written to the Metropolitan Brass Founders' Association, on the question of Workmen's Compensation Insurance rates as applied to brass foundries. The foundries casting high lead mixtures have a high occupational disease rate and this has caused a general rise in insurance rates to all brass foundries. It is this rise to which Mr. Harper objects.—Ed.

---

Metropolitan Brass Founder's Association:

Last spring, 1926, in conversation with a State Insurance Factory Inspector I asked for an explanation as to the recent high increase in the rates of Workmen's Compensation. He stated that the increase was due to the new amendments to the law increasing the compensation and adding to the law a new clause providing for liability for disability or death due to occupational diseases and in the event of death awards were now made to the widow and, or, his dependents. He cited as an example that in Rensselaer County, New York, one foundry during the last year had had four deaths due to lead poisoning and the wives and dependents had to be supported. I made inquiry as to the percentage of lead the alloys were carrying. He could not give the exact percentage but the impression was conveyed that it was 40 or 50%.

Vigorous protest was made by me against including this concern in the classification of Brass Foundries, that they were not making alloys common to the brass foundry industry and it was not just that the brass foundry industry should have to carry this liability. In about twenty-five years there would be about 100 widows and about three or four hundred dependents for that one firm in Rensselaer County alone that would have to be cared for. It will amount to hundreds of thousands of dollars per year that will be assessed unfairly against about 325 firms engaged in the brass foundry industry in New York State, by this one foundry alone. At this rate, in a few years this one firm engaged in making high leaded alloys will put the brass foundries among the most hazardous occupations, so far as rates are concerned, in the country. It is my contention that the brass foundry industry should not be penalized for an occupational disease *not common* to the industry for the benefit of the makers of an alloy *not common* to the industry. The makers of high lead alloys should be separately classified and pay their own liabilities. The inspector said he would report my objections.

In a few weeks I received a letter from the "State Insurance Fund" saying that my criticisms had been reported in regard to Occupational Diseases and the Rensselaer County firm's high mortality caused by making certain alloys. But the State Insurance rate-making body could not discriminate between firms in the industry that had to supply to their customers different percentages of metals in alloys to meet their customers' different requirements. The tone of the letter seemed to be "That's that, and that settles that," whether it was just or unjust as applied to other firms not making high-lead alloys.

In again taking exception (over the phone) to the advanced premium on account of the Employers' Liability for the ensuing year which I considered too high (nearly twice as much as the previous years), the case of the Rensselaer County firm was again discussed with an auditor and again I stated my objections. I said that I believed that the objections made would be sustained by the whole of the brass foundry industry and because of that belief at the first opportunity I would bring the matter up before the Metropolitan Brass Founders' Association as a representative body of the industry in New York State. The auditor's opinion was that if a representative body of the industry such as the Metropolitan Brass Founders' Association would state their position in this matter it would have sufficient weight to get proper and full consideration of the objections made against including the high-lead alloy manufacturers in the brass foundries classification for Employers' Liability purposes.

Every employer knows that the increase in the Employers' Liability is an indirect increase in the wages of labor that is never taken into consideration by the employees, and this expense is entitled to as much consideration as an advance in direct wages. Strict inquiry and protest should be made when the industry is called upon by the State Government to pay rates to cover the extra hazardous manufacture of high-lead alloys *not common* to the industry. Especially since the employees *common* to the industry do not receive the benefit and the protection of the high rates assessed and paid by the employers on the behalf of labor under the present Rating Board's rulings.

As long as the present classification prevails the industry will see a further increase in the rates for Workmen's Compensation each succeeding year. And these advances will be out of all proportion to the individual experience of the average brass foundry owner.

THOMAS HARPER.

New York, N. Y.
October 18, 1926.

## New Books

**A Study of Tests for Refractories, with Special Reference to Spalling Tests.** By Stuart M. Phelps. Published by American Refractories Institute, Oliver Building, Pittsburgh, Pa. Size 6 x 9, 27 pages. Price, 50 cents.

The author, who is an Industrial Fellow of the Mellon Institute in Pittsburgh, Pa., made a study for the American Refractories Institute. This institute has been greatly concerned with the subject of specifications and its Research Division has collected a great many test data and also conducted a large number of studies of tests with the object of improving these procedures wherever possible. The subject matter of this pamphlet is largely a presentation of such findings.

The work covers a study of load tests and spalling tests. In addition, studies were made of "service spalling" in which a small panel of test brick was set up to simulate a section of a furnace wall.

Many of the findings presented are of extremely promising value. New test procedures are recommended and suggestions given regarding the use of test data.

**Chemical Engineering Catalog.** Published by the Chemical Catalog Company. Size 9 x 12, 1175 pages. Price, $10 to all except those engaged in working or teaching in chemical industries and in the technical departments of the government and libraries. To them, the catalog is leased at $2.00 per copy for one year.

The Chemical Engineering Catalog is a standard work of reference for those who use, buy and specify equipment and materials in the industries using chemical processes. It is a compilation of catalog data standardized as to page size and alphabetical arrangement and supplemented by a classified index of equipment, supplies and materials. It is published annually under the supervision of an official committee of the American Institute of Chemical Engineers, American Chemical Society, and the Society of the Chemical Industry.

Departments and lines producing and using metals have a most important part in the chemical industry. For that reason a catalog of this sort is of value to metal manufacturers and users.

# SHOP PROBLEMS

**IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE**



## BLUING GUN BARRELS

Q.—We have had several calls for bluing gun barrels, pistols, etc., but not being familiar with this type of plating or oxidizing, have not been able to do the work.

In order to take care of this work in the future am writing to ask if you could give me the formula.

A.—The most satisfactory method of bluing gun and pistol barrels is by the heat method. For this purpose a small steel tank should be used of sufficient dimensions so that the gun or pistol barrels can be completely immersed.

The mixture consists of 2 parts sodium nitrate and 1 part sodium nitrite. It should be heated to a minimum of 700 deg. F. Browns, blues and blacks can be obtained from 400 to 700 deg. F. The articles should be polished to a lustre, cleansed in gasoline and dried out. To avoid any moisture, heat the gun barrels or pistol barrels to 212 deg. F., before immersing in the molten mixture. As soon as the correct color is produced, remove the barrels and quench in cold water; dry out in hot water and wipe dry with cloths. Apply a thin coat of linseed oil with a soft cloth or a thin coat of Johnson's floor wax. When partly dry, polish with cloth. The method we have given is used extensively in the metal and gun industries.—C. H. P. Problem 3,575.

## BRIGHT DIP FOR WHITE GOLD

Q.—Can you give me any information by return mail of the process used in the East for bright dipping white gold rings as, I believe, they call stripping.

A.—The method to which you refer is known as the electro-stripping or removing the green from gold. The solution should be prepared as follows:

| | |
|---|---|
| Water (Temp. 160 deg. F.) | 1 gal. |
| Sodium cyanide 96-98% | 8 ozs. |
| Rochelle salts | 2 ozs. |
| Phosphate of ammonia | 1 oz. |

The articles are made the anodes; for cathodes, use sheet lead which should entirely surround the articles to be stripped. For best results keep the articles in a gentle motion to and fro while stripping. They will then be bright and clean.—C. H. P. Problem 3,576.

## PINK ROSE GOLD

Q.—I have been trying to get a formula for a pink rose gold that will adhere and one for all metal. Also a good formula for a white gold, oxidized black that will adhere when washed in hot ammonia water.

A.—The following formula will give you a pink rose gold. By manipulation, first use a high voltage, 6 to 8 for a minute or so then remove. Relieve the highlights with bicarbonate of soda, then flash the articles again in the same solution at 3 volts. The high voltage produces the rose tone; the low voltage the yellow tone.

| | |
|---|---|
| Water | 1 gallon |
| Yellow prussiate of potash | 2 ozs. |
| Sodium gold cyanide | ⅓ oz. |
| Carbonate of soda crystals | 2 ozs. |
| Sodium cyanide 96-98% | ⅛ to ¼ oz. |

Use about one-third of the water first, then add the materials in the order given, then the balance of the water. Fine gold anodes should be used.—C. H. P. Problem 3,577.

## PLATING DIE CASTING

Q.—I am a plater for a firm which makes automotive specialties, radiator caps, etc., from die castings. The metal used is manganese. I recently installed a three-hundred-gallon nickel solution; water 1 gallon, single nickel salts, 6 ozs., double nickel salts, 2 ozs., common salts, 2 ozs., sodium citrate, 3 ozs., epsom salts, 1 oz. This tank has a mechanical agitator. It seems when the agitator is working certain white spots show up which slows up the color buffing to a certain extent. When using this solution as a still tank it plates white all over and when buffed has a good color. The only trouble is that in still plating the work burns so easily. Have tried sulphuric acid which made a bright deposit but certain parts of the work still had the white spots.

A.—Your nickel solution is of a normal nature for nickel plating die castings. Recent improvements in such formula, however, have improved the deposit. The following formula is made by one of the largest manufacturers of automobile die castings in Detroit.

| | |
|---|---|
| Water | 1 gallon |
| Single nickel salts | 12 ozs. |
| Sal-ammoniac | 2 ozs. |
| Nickel chloride | 1 oz. |
| Boric acid | 1 oz. |
| Sodium sulphate crystals | 12 ozs. |
| Cadmium chloride | 1/32 oz. |

This solution produces a bright nickel deposit which requires no buffing. You can improve your present solution by adding to it based upon the above formula. Your solution is too low in metal for an agitated solution, unless the agitation is reduced to a minimum. As a still solution it is conductive but with the voltage necessary to cover the die castings over quickly with nickel, the deposit becomes burned. By adding single nickel salts, possibly 4 ozs., and 8 ozs. of sodium sulphate per gallon with 1/32 oz. of cadmium chloride per gallon, you should obtain satisfactory nickel deposits with the mechanically agitated solution.—C. H. P. Problem 3,578.

## POLISHED TIN PLATE

Q.—I have a tin solution which deposits well until the backs are polished, and when washed out for removing crocus they turn black. The wash is made up of fish soap. Will you give me a formula for same? Rosin seems to make the deposit too hard. I use phosphate of soda and tin chloride crystals and the rosin. Below you will find formula which I use.

ALKALINE TIN

| | |
|---|---|
| Water | 1 gallon |
| Phosphate of soda | 4 ozs. |
| Chloride of tin | 3 ozs. |
| Rosin | ½ oz. |

A.—We presume that the tin solution you use is for flashing white gold articles to prevent tarnishing. If so, try the following solutions.

| | |
|---|---|
| Water | 1 gallon |
| Sodium cyanide 96-98% | 5 ozs. |
| Tin chloride | 1 oz. |
| Phosphate of soda | 3 ozs. |

Temp. 160-180 deg. F. Use tin or steel anodes. Voltage 4 to 5. To prepare the solution, dissolve the sodium cyanide in 1 pint hot water, the tin chloride in another pint of water, then add the the phosphate of soda; mix thoroughly; add to the cyanide solution; finally the balance of 3 quarts of water.

| | |
|---|---|
| Water | 1 gallon |
| Sodium cyanide | 1 oz. |
| Cadmium oxide | ¼ oz. |
| Caustic potash | ⅛ oz. |

Dissolve these 3 factors in 1 pint hot water in the order given, then add the balance of the water; use a cadmium or steel anode. Temperature and current as above.

These solutions are primarily for flash deposits. When cleansing an electro-tin plated surface after buffing, only a very mild cleaner should be used. Try water, 1 gallon; trisodium phosphate, 1 oz.; powdered borax 1 oz. Increase these amounts to 1½ to 2 ozs. each if necessary.—C. H. P. Problem 3,579.

## SILVERING MIRRORS

Q. I have been having a little difficulty in silvering small glass mirrors. Small spots are visible when you look into them. Can you furnish me with a formula for silvering the same?

A. The spots that you mention are due to dust in your silvering room or improper cleaning of the mirrors. The cleaning is one of the most important parts of the process as the surface must be chemically clean. The use of mild alkaline cleaners for this purpose is advisable. Such cleaners are advertised in THE METAL INDUSTRY, and can be used in the proportion of 4 to 8 ozs. per gallon of hot water. Wash the glass afterward thoroughly with water, then flow over the glass a mixture of 1 part nitric acid and 8 parts water. Re-wash thoroughly and proceed with the regular silvering operations consisting of sensitizing, washing, draining and applying the silvering solution.

Good solutions for these operations are as follows:

Sensitizing Solution

| | |
|---|---|
| Distilled water | 1 quart |
| Chloride of tin crystals | ½ oz. |

Silvering solution No. 1.—Stock solution:

| | |
|---|---|
| Distilled water | 20 fluid ozs. |
| Pure nitrate of silver crystals | 3 ozs. |
| 26% aqua ammonia | 2 ozs. |

To prepare the solution, dissolve the nitrate of silver in part of the water first at a temperature of 100°F. Then add the balance of the water, then the ammonia. A brown precipitate will result which will redissolve. The solution should be filtered by the aid of a glass funnel and chemically prepared filtering paper.

Silvering solution No. 2.—Reducing solution:

| | |
|---|---|
| Distilled water | 5 ozs. |
| Tartaric acid crystals | 1 oz. |

Filter the solution as outlined above.

Silvering solution No. 3.—Used in silvering operations:

| | |
|---|---|
| Stock solution No. 1 | 1½ fluid ozs. |
| Distilled water | 16 fluid ozs. |
| Reducing solution No. 2 | ⅛ oz. |

Stir the solution thoroughly with a glass rod. Any proportions may be made upon the above basis. Keep each combination separately in dark colored bottles away from the daylight or sunlight, mixing them only as required for use.—C. H. P. Problem 3,580.

## SPOTTED BRASS

Q.—Please advise reasons for the spots which appear on enclosed chain link. Am also enclosing a bright link. Are the spots due to the chemical solution or to the surface of the bright links which are not clean enough for plating?

A.—After a careful examination of the brass plated steel chain links, we have decided that the spotting follows the brass plating. In other words, it is a species of the well known spotting out problem that develops so seriously in the humid summer months. To prove this contention the lacquer was removed from the sample with a suitable solvent that did not react upon the brass deposit. The sample was then washed in water and immersed in a cyanide dip to remove the spots; again rewashed in water and thoroughly dried out. The unfinished link, under a powerful magnifying glass, shows imperfections in the steel which may be oxides. These imperfections may become porous under the cleansing and plating operations and the solution becomes occluded and finally spots out under the lacquer.

We suggest more careful washing. After plating, immersion in hot water at 200 deg. F. containing carbolic acid ⅛ to ¼ oz. per gallon will help to overcome the spotting out by neutralizing the solution in the pores of the metal. Careful drying by heat before lacquering should eliminate your problem.—C. H. P. Problem 3,581.

## SPRAYED STOP-OFF

Q.—Please advise if you know of a fast method of coating a die cast radiator cap, with a wax for protecting a part of the casting in order to copper plate a small portion of the surface.

We first intend to nickel plate the entire casting and then we want to apply the protective wax or suitable solution with an air pressure gun. After the copper plate is on we want to rinse the casting in hot water and dissolve the protective wax.

Do you know of a suitable wax that will work in the air gun and perform with the above application?

A.—Fluid waxes suitable for spraying purposes as a stop-off in plating operations cannot be used advantageously. Furthermore, cyanide copper solutions will readily dissolve thin coatings of wax used to protect the metal surface from deposition of a second metal. In our opinion, air drying asphaltum varnish would be most suitable for your purpose, and can be purchased from most paint dealers. The varnish has a turpentine basis so if too thick for spraying purposes, could be thinned down with turpentine or benzine. It would be to your interest to copper plate first, then nickel plate if possible. The asphaltum varnish can be removed in a moment or two with benzine, benzole or gasoline.—C. H. P. Problem 3,582.

## SPOTTING OUT

Q.—Could you give me any formula for bronze plating that will overcome the sweating out that takes place after the casting is lacquered? Have tried a weak sulphuric acid dip, but it has not been satisfactory.

A.—We presume that your term "sweating" of the bronze plated casting is the regular spotting out problem that becomes so universal in all parts of the country during the humid weather. As this problem is a conditional one, we do not believe that any decided change in your solution would overcome it. The solution should be replenished with only sodium cyanide, copper cyanide and sodium bisulphite in the proportion of 1 lb. of cyanide, 1 lb. of copper and 2 ozs. of bisulphite of soda dissolved in 1 gallon of hot water. The bisulphite of soda should be added direct to the plating solution, however, and not to the hot cyanide and copper solution. If plenty of anodes are used in the bronze solution, consisting of 90% copper and 10% zinc, then about the only addition that will be required for the upkeep of the solution per gallon per day when constantly used, would be ⅛ oz. of sodium cyanide and 1/32 oz. bisulphite of soda.

To eliminate the spotting out, boil the castings out in hot water (after thoroughly washing in cold water). To the hot water add ¼ oz. glacial phosphoric acid per gallon. You might also experiment with carbolic acid, using ⅛ to ¼ oz. per gallon of water at 200° F. After the acid treatment, re-wash in boiling water and dry out, if possible, at 212° F.—C. H. P. Problem 3,583.

## YELLOW BRASS ON CAST IRON

Q.—We wish to inquire if you can help us in producing a good yellow brass plate on small pieces of soft gray iron casting. We are operating a 400-gallon brass solution at the present time, which we are running warm.

The present solution consists of cyanide carbonate of copper, carbonate of zinc, and ammonia, with brass anodes. We have been cleaning the castings in a cleaner solution before plating, but it seems as though we do not get a good brass color on our casting. It appears a sort of a bronze color and after scratch brushing, the casting looks as though it was blackened or darkened.

A.—Possibly your castings are over-pickled; to remove the sand, etc. Such castings are more difficult to brass plate than a sand blasted casting. You might try flashing the castings first with a thin deposit of nickel. If you run your solution warm in an effort to produce a yellow brass deposit, then the indications are that your solution is too low in copper and presumably sodium cyanide. Before discarding the solution make a test as follows. To a 10-gallon test solution add 2 ozs. sodium cyanide and 1 oz. copper cyanide per gallon and 1 oz. bisulphite of soda. Try out this replenished solution. If the color is of a copper tint, then add from ½ to 1 oz. of sal-ammoniac per gallon. The results should be a good brass. On page 9 of Platers Wrinkles will be found an excellent formula for brass solution.

If you prepare this solution, first dissolve the sodium copper and zinc cyanides in one-third the water at a temperature of 160 deg. F. Add the balance of the water, then the bicarbonate of soda and ammonium chloride. Stir well and the solution is ready for use at a temperature of 80 deg. F. Read the three paragraphs following the solution formula for additional data covering brass solution and anodes.—C. H. P. Problem 3,584.

# PATENTS

## A REVIEW OF CURRENT PATENTS OF INTEREST

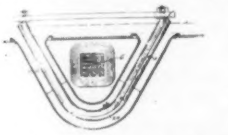
1,598,664. September 7, 1926. **Cleaning Composition.** Joseph Le Verne Teach, Chicago, Ill.

The herein described cleansing compound which consists of a white creamy emulsion of syrup-like consistency containing substantially one hundred parts of kerosene, thirteen parts oleic acid, fifty parts of water, and three and one-half parts of 26 per cent aqueous ammonia.

1,598,668. September 7, 1926. **Dental Casting Material.** Robert Morse Withycombe, Sydney, New South Wales, Australia.

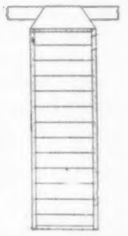
A composition of matter comprising a mixture of suitable proportions of oxide of copper and sulphur formed into a homogeneous mass by application of heat.

1,599,161. September 7, 1926. **Core for Induction Furnaces.** Charles A. Brayton, Jr., Cleveland, Ohio, assignor to The Induction Furnace Company, Cleveland, Ohio.



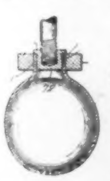
In an induction furnace, an expanding channel core wherein an unfilled space is provided longitudinally of the channel centre, whereby part of said space may be occupied upon a subsequent shifting of the core members.

1,599,284. September 7, 1926. **Anode Holder,** Charles Henry Proctor, Arlington, N. J., assignor to the Roessler & Hasslacher Chemical Company, New York, N. Y.



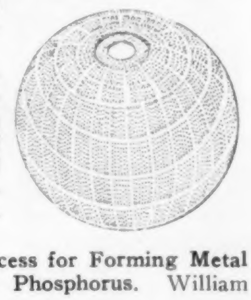
An anode holder which comprises a box for holding a plurality of anode bars, said box having a substantially open face, and an open top permitting new bars to be readily dropped into the box as those therein are plated away.

1,599,349. Septemebr 7, 1926. **Electrolytically-formed Hollow Metal Article and the Method of Its Manufacture.** Wirt R. Robinson, Baltimore, Md.



An electro-formed seamless hermetically sealed hollow metal article comprising an electro-formed hollow body having a hollow electro-formed integral neck extending substantially radially outwards therefrom and a closure applied upon and secured within the outer end of said neck by cement comprising a screw plug, the outer periphery thereof being threaded into the inner periphery of said neck, said plug having means thereon whereby it may be threaded into said neck and over said closure whereby said closure may be ing part way down said plug and reinforcing layer of electrolytic metal around the portion of said article adjacent to said neck and over said closure whereby said closure may be secured to said article by said thread cement and reinforcing plating layer.

1,599,608. September 14, 1926. **Electroplated Article and Method of Making Same.** John Rowland Brown and John C. Mullinnix, Cleveland, Ohio, assignors to The Reliance Gauge Column Company, Cleveland, Ohio.



In a method of electroplating a nonmetallic article, the steps which consist in first coating such article with a cellulose derivative on the order of celluloid, then applying a coating of electro-conductive material, and thereupon electrolytically depositing the desired metal.

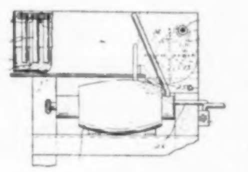
1,599,618. September 14, 1926. **Process for Forming Metal Compounds and Mixtures Involving Phosphorus.** William Koehler, Cleveland, Ohio.

The process of producing metallic phosphides, consisting in mixing a finely comminuted metal with phosphorus in a finely divided condition and then subjecting the mixture to a predetermined pressure.

1,599,624. September 14, 1926. **Die-Casting Machine.** Marc Stern, Detroit, Mich., assignor to Doehler Die-Casting Company, a corporation of New York.

A die-casting machine comprising a pressure chamber for the material to be cast provided with a discharge nozzle, a movable die carrier for one part of a sectional die, a movable die carrier for another part of the sectional die, means for moving the die carriers relative to each other and to the nozzle to close the die and clump it to the nozzle and to hold the die for a time at the casting position and thereafter to unclamp the die from the nozzle and separate the die sections, mechanism for automatically operating said means through a complete cycle, means for applying pressure to the material in the pressure chamber to force said material into the die, mechanism for automatically operating said pressure-applying means to apply and release the pressure during the time that the die is closed and clamped to the nozzle, and automatically operated core-pulling mechanism for withdrawing cores from the die and repositioning them therein.

1,599,701. September 14, 1926. **Electrolytic Apparatus.** Herbert P. Elwell, Tacoma, Wash.



In an electrolytic apparatus, a tank, means for circulating mercury through said tank, means for circulating a metallic salt in solution through said tank, counter to the flow of the mercury, and means within said tank for electrolytically decomposing said salt.

1,599,869. September 14, 1926. **Process of Manufacturing Aluminum Alloy.** Pierre Berthélemy and Henry de Montby, Paris, France.

A process for the manufacture of an aluminum alloy comprising fusing in a plumbago crucible lined with magnesia and containing a mixture of wood charcoal, calcium fluoride, oxide of magnesium, and arsenious acid, a mixture of copper, manganese, ferro-silicon, tungsten, magnesium, and aluminum, so as to produce a rich alloy, scouring the rich alloy, running the rich alloy into ingot moulds, and subsequently mixing the rich alloy with pure aluminum.

1,600,076. September 14, 1926. **Electrodeposition of Metallic Chromium.** Eiji Suzuki, Tokyo, Japan, assignor to General Electric Company, a corporation of New York.

A process for the electro-deposition of metallic chromium consisting in conducting an electrolyzing current through a solution containing chromic acid 5 to 10 per cent, chromium sulphate 5 to 15 per cent, boric acid 5 per cent from a lead anode to the article to be coated as a cathode.

1,598,295. August 31, 1926. **Electrodeposition of Tin.** Horace Russell McIlhenney, Rahway, N. J., assignor to Vulcan Detinning Company, Sewaren, N. J.

The improvement in the electrodeposition of tin employing an appropriate electrolyte, which comprises supplying tin to the electrolyte by the introduction thereto of a compound of tin that is substantially insoluble in water but soluble in the products of the electrolysis forming in the electrolyte as electrodeposition proceeds.

## OXYGEN PATENTS HELD INVALID

A year ago, it was announced that suit had been filed against a user of a Messer oxygen producing plant by the Air Reduction Company.

The Keith Dunham Company, 110 South Dearborn street, Chicago, Ill., who are the sole agents for the Messer oxygen manufacturing unit, announce that this suit was defended by them, and on September 18, 1926, Federal Judge Morris at Wilmington, Del., decided the suit in favor of the defendant holding both patents invalid. A portion of his opinion states:

"The patent is purely a paper patent whose application remained long in the patent office. It has made no imprint upon the art."

This decision is of considerable importance to the metal industry as at the present time there are 60 Oxeco liquefaction oxygen plants in successful operation in the United States.

# EQUIPMENT

## NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

## Surface Decoration and Protection of Aluminum and Aluminum Alloys

Written for The Metal Industry by Dr. ALFRED GRADENWITZ, Berlin, Germany

B. Jirotka, of Berlin, Germany, has for more than seven years been engaged in attempts to devise a process of protecting aluminum surfaces from oxidation, providing, in addition to actual protection, a means of changing and coloring, at will, the surface of the metal. After overcoming many difficulties he has at length succeeded in solving the problem in such remarkable manner as to open up for the use of aluminum and other light metals unthought-of possibilities.

This result is obtained by a simple dipping process rather than by galvanic means, the surface of the metal being varied at will by the use of about 80 different combinations of metal baths. Aluminum objects—according to the coating actually chosen—are imparted the perfect appearance of copper, bronze, gold, silver, nickel, etc., though a patina of absolute likeness to a natural one, or an opalescent surface can be obtained. Aluminum objects treated in this manner not only resemble in appearance those made of massive heavy metals, but are in many cases of even superior brilliancy.

The outfit used in applying the process is extremely simple,

DR. JIROTKA'S LABORATORY, BERLIN, GERMANY.

mainly consisting of a heating plant (operated by electricity or gas) which enables the baths contained in enameled vessels to be kept at the proper temperature (up to 90° C.). This, of course, depends on the kind of coating actually desired, tepid or even cold baths being sometimes used. The metallic combination of the aluminum with the metallic substance of the bath is effected by purely chemical and not galvanic means. Only in the event of particularly high stresses having to be dealt with, will it prove desirable to reinforce galvanically the deposits obtained by the simple dipping process.

The baths used in this connection are perfectly self-acting, brilliant or patinated objects or any other variety being obtained at will. They will work exactly like atmospheric oxygen; whereas elevated portions take little or no patina, and all the more intense formation of patina will take place at the deeper parts. Hollow objects, such as soldiers' flasks or any other vessels, will take a uniform coating inside as well as out.

The duration of the treatment is very short, being sometimes a few seconds and at the outside some minutes; the size of objects is of no importance in this connection.

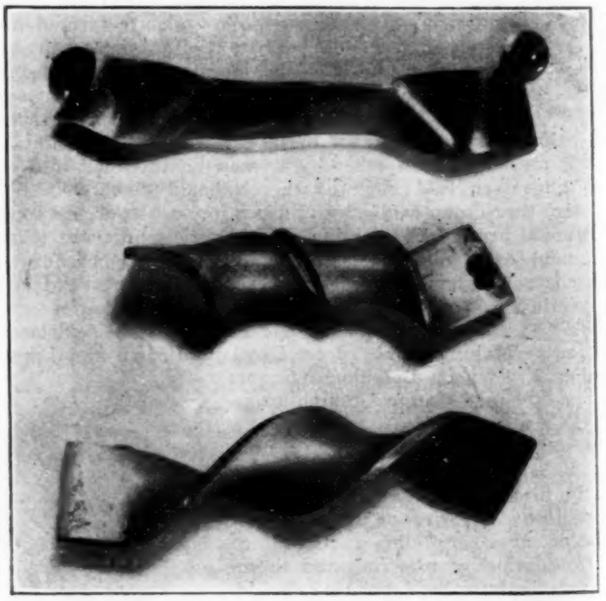
Operating expenses are quite low, the coating of one square metre—according to the bath actually used—entailing an expenditure of from 1 cent to 2½ cents.

The possible uses of aluminum thus refined are so manifold as to make any exhaustive discussion impossible. In order here to quote one instance, it can be stated that a perfect coating of a greyish blue, resembling glazed porcelain, is used in dealing with motor-car bodies. This coating has a high brilliancy, is resistant to mechanical injury and can be washed with hot or cold water. Unlike the usual varnish coating, which it takes several weeks to apply and dry, it will be ready for use after a few minutes.

Any other vehicles, e.g., railroad cars and airplanes, can as well be made of aluminum fittings with the same protective coating. Ship outfits of aluminum will be protected by means of Jirotka coatings against the action of atmospheric agents and sea water. In connection with roofings, coated aluminum sheets are found to be an excellent substitute for the tinplate.

Copper-coated aluminum should, in the electrical industry, play an important part as a substitute for the much more expensive copper, and the same applies to the scientific instrument trade which will find it a suitable material in making a large variety of instruments and apparatus. Chandeliers and other lamps made of refined aluminum, rather than of such metals as bronze and brass castings, will prove particularly effective. Like motor-car bodies they are immersed bodily and by a single dipping, endowed with the colors and durability of the most expensive lamps of bronze, gold, silver, etc.

The use of aluminum fitted with protective coatings will prove of importance also in manufacturing table requisites, kitchen utensils, soldiers' flasks, hair-driers, bath-room outfits, wall pegs, door handles and fittings, etc., all of which were formerly made of aluminum and affected by the drawbacks



METAL COATED ALUMINUM SUBJECTED TO TWISTING TESTS

above referred to. Coffee and tea machines, as well as electrical radiators will be made to advantage of aluminum thus refined.

Aluminum alloys such as Silumin and Duralumin, as well as any other light metals, such as Elektron, are, like aluminum, fitted with coatings on the new process.

According to researches at Messrs. Telefunken's Tropical Laboratory, objects of refined aluminum will readily stand

temperatures of 42° C. and 92 per cent air moisture. Apart from a slight darkening, they will not undergo any alteration.

Interesting results have been obtained in connection with tests made by the **Chemisch-Technische Reichsanstalt,** of Berlin, on the adhesive strength of Jirotka coatings. No alteration was noted in the appearance of the surface up to the elastic limit, after exceeding which the sample bar at the contraction point would become slightly brighter, though the coating was never found to come off. Nor was an exfoliation of the surface noted in connection with bending tests, while slight cracks were produced only when the aluminum was made to flow by very strong bending. Twisting tests likewise showed how firmly the coatings adhered, not even cracks being noted in this connection. Another test was made by the Erichsen process, slight cracks being formed only at the top of the buckle in connection with extremely high stresses, when the metal was beginning to flow freely. A compression test finally showed in the elastic limit no change and, even after exceeding it, no exfoliation of the coating was produced. Nor will the coating be severed by hammering.

The results of chemical tests made at the same government laboratory are quite as conclusive: Aluminum sheets either polished or dull, which had been treated according to the Jirotka process, were submitted in parallel tests to the influences of atmospheric agents, distilled water, tap water and sea water respectively, for three months. Material having undergone the treatment was practically unaltered, corrosion phenomena being noted only at those places where defects in the material had been ascertained.

The inventor has come to this country and an American firm, the Otto Sprenger Corporation has been formed with permanent headquarters at 183 Madison avenue, New York, with showrooms and laboratories, where the inventor is prepared to demonstrate the process.

## FLUELESS BOILER

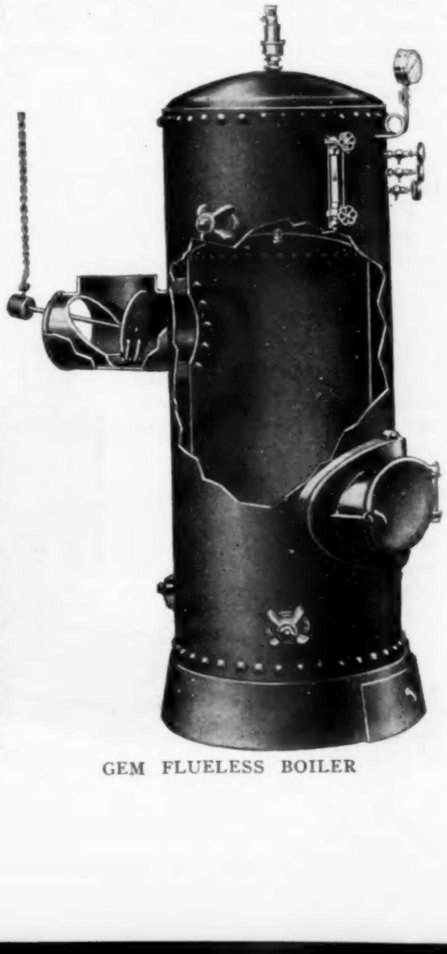
The Gem City Boiler Company, of Dayton, Ohio, is manufacturing a vertical boiler without flues, sizes ranging from 1½ to 30 h.p. The cut shows how the firebox is constructed. At the top of the firebox is the crown sheet, where the fusible plug is located. The boiler can be briefly described as a "two-in-one" boiler. The smaller boiler is located in the center with a larger boiler built around the inside boiler. It is rivited together at the bottom. Between the two shells a space is left that is called the water leg. The water level is carried above the crown sheet, as shown in the cut.

Tests of this boiler conducted by Professors E. L. Ohle, and F. A. Berger, of the Washington University, St. Louis, Mo., show that this boiler can be operated at remarkable savings. According to the manufacturers' reports the greatest advantages enjoyed are the saving of labor, fuel, and the elimination of repairs.

For years flues in boilers have been the direct source of considerable expense and delays to its users. This applies particularly in territories where boilers with flues will not give more than 8 to 12 months service, due to hard water.

Soot or unburnt coal deposits quickly on the tubes of other type boilers. The high firebox of the flueless boiler makes it possible to obtain complete combustion with the poorest grade of coal, thereby maintaining a clean heating surface at all times. The boiler is adapted for burning oil. Fire brick is placed around the water leg at bottom to protect the rivets. An oil burner can be furnished by the distributors which can be easily installed. It burns 18-20 gravity oil, and is atomized with steam furnished by the boiler. A patented check damper control can be purchased at an additional cost.

The "Original" Gem Flueless Boiler complies with the A. S. M. E. Code. The Monarch Sales & Engineering Co., who maintain offices at 363 W. Erie street, Chicago, Ill., and 2010 Locust street, St. Louis, Mo., are the national distributors. A new booklet, "Proof of the Pudding," has just been released which will be mailed free upon request.

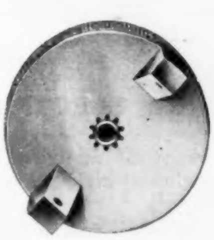


GEM FLUELESS BOILER

## NEW SPRAY NOZZLE

The Eureka Pneumatic Spray Company, Richmond Hill, Long Island, N. Y., is offering an innovation in spray guns. This house has been manufacturing sprayers for finishing purposes for over twenty-seven years.

The latest improvement consists of a dependable self-centering arrangement of air and fluid nozzles on a spray gun, air nozzle being guided into and held in position by the fluid nozzle in a manner which, it is said, precludes the possibility of these members being other than absolutely concentric. In guns where the air and fluid nozzles depend only upon machine threadings for their position, there can never be a certainty of these nozzles being concentric, and this results in an unequal or distorted spray. The latest improvement in the Eureka line, it is claimed, assures accurate concentrity at all times and is practically fool-proof. Instead of having an annular space between the air and fluid nozzle, this latest air nozzle has a serrated central aperture, the inner portions of the serrations acting as a guide encircling the fluid nozzle, and at all times assuring accuracy of position. At the same time it is found that this construction greatly benefits the spray which is delivered in a uniform density, free from the irregularities and fishtail effect commonly observed in the flat or fan shaped spray.



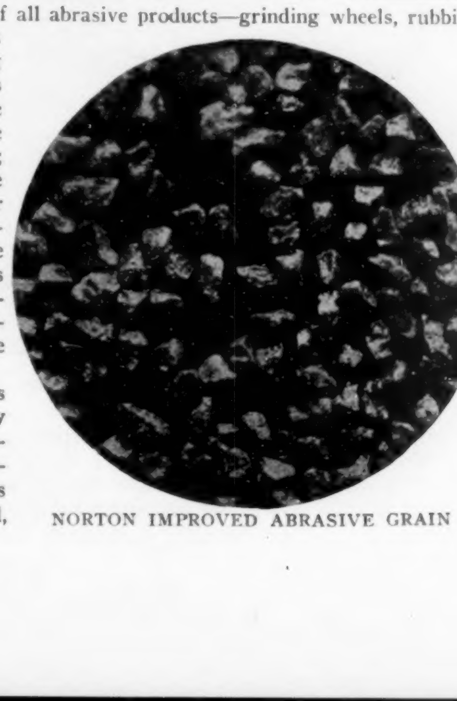
NEW EUREKA NOZZLE

This nozzle arrangement is embodied in Eureka gun sprayer No. 150; also in their container type of sprayer model No. 44. It is also claimed through this improvement that the spray is delivered to the surface in uniform density and leaving almost no perceptible blended edge, giving a result very close to that produced by a brush.

## AN IMPROVED ABRASIVE GRAIN

The efficiency of all abrasive products—grinding wheels, rubbing bricks and sticks and the polishing grain — depends principally on the character of the abrasive particles; their size, shape and strength. For some time the efforts of abrasive manufacturers have been directed toward improving these characteristics.

The grain is obtained by crushing the abrasive and screening it. There has always appeared,



NORTON IMPROVED ABRASIVE GRAIN

no matter how carefully the material has been prepared, a certain percentage of weak grains—grains irregular in shape, long and slivery. The percentage has been small, but even the smallest percentage is undesirable.

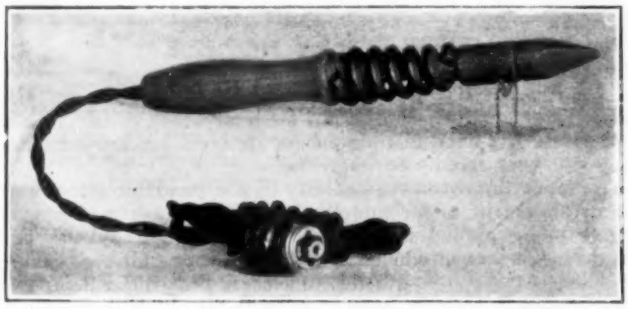
Norton Company, Worcester, Mass., has developed a new process using new equipment for treating their Alundum and Crystolon abrasives—a process that eliminates the weak, flat, slivery grains. The result is said to be an abrasive more uniform in size, more uniform in strength and more uniform in shape.

Grinding wheels made of the improved grain, it is claimed, have a more even structure, presenting to the work being ground a greater number of cutting particles, more evenly spaced and more even in strength. The result is a better grinding action, thereby an increase in production. Also, this more uniform structure of the wheel decreases somewhat the number of dressings necessary.

In polishing work, the improvement is even more noticeable. The greater uniformity in the size, shape and strength gives much faster production and also an improved finish.

## NEW SOLDERING IRON

The General Electric Company is now marketing a new soldering iron of light construction, designed to heat up quickly. This iron is made in standard sizes ranging from ½" to 1¼" tip.



WOODEN HANDLE SOLDERING IRON

Power consumption ranges from 70 watts for the smaller iron for light and intermittent use, to 350 watts for the larger size on heavy duty. The irons for heavy duty are provided with radiating stands for the purpose of maintaining the iron at the correct operating temperature when temporarily not in use. The rapid rate of initial heating is brought about by unusually good heat conduction between the heating element and the copper tip. Heat from the tip is prevented from reaching the handle by means of a special mechanical construction between the two, this being in the form of a spiral made from a steel rod. This also provides a rigid connection between the handle and tip.

Instead of mica, usually used for an electrical insulator in the heating unit of soldering irons of this type, the heating unit has an insulating powder so highly compressed that it becomes a good heat conductor and will withstand temperatures of more than 2,000° F.

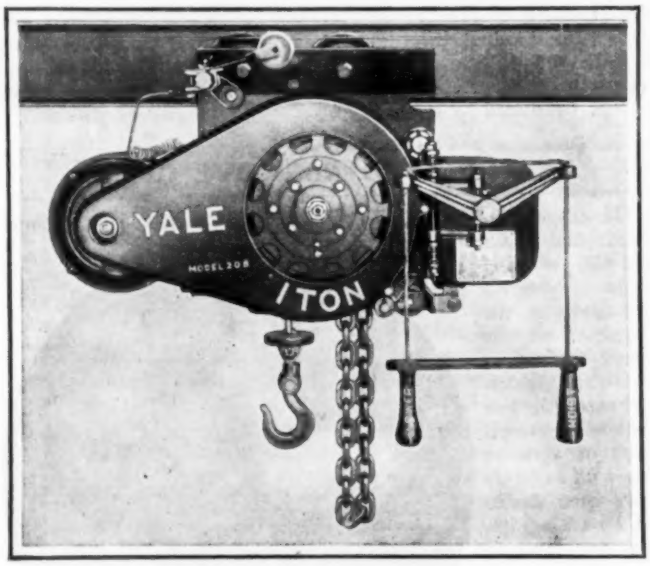
The iron is provided with a standard lead and connection plug. All parts are equally replaceable.

## NEW ELECTRIC CHAIN HOIST

The Yale & Towne Manufacturing Company of Stamford, Conn., has recently developed a new ball-bearing electric chain hoist known as Model 20B.

This hoist embodies such features as close headroom, long lift, higher speed, automatic top and bottom limit stops, and greater over-all strength. It is said to have very unusual factors of safety in the strength of the load-supporting members and be designed to withstand shock loads so common to this class of equipment. It can be quickly adapted to any overhead system as the side plates of the trolley carriage can be spaced on steel bars to fit the desired beam flange.

The mechanism is fully enclosed in oil-tight chambers and is compact and easily accessible for inspection without expert service. The ball-bearing load sheave, the latest Yale development, it is claimed adds a big factor for low current consumption and general all-around hoisting efficiency.




BALL BEARING ELECTRIC CHAIN HOIST

The heavy steel one-piece load sheave, ground on an arbor to give perfect concentricity for the ball races, is bronze-bushed for the driving pinion, and splash lubrication provides a continuous flow of oil over all gears, pinions and bearings.

The driving pinion that passes through the load sheave is machined from a single drop forging, then heat-treated. The bearing surfaces on the shaft are ground to 1/1000 of an inch.

## HIGH-SPEED TAPPING MACHINE

An automatic tapping machine designed for high-speed production work is made by the Hart & Hegeman Manufacturing Company, Hartford, Conn. This machine is intended for small sheet-metal parts.

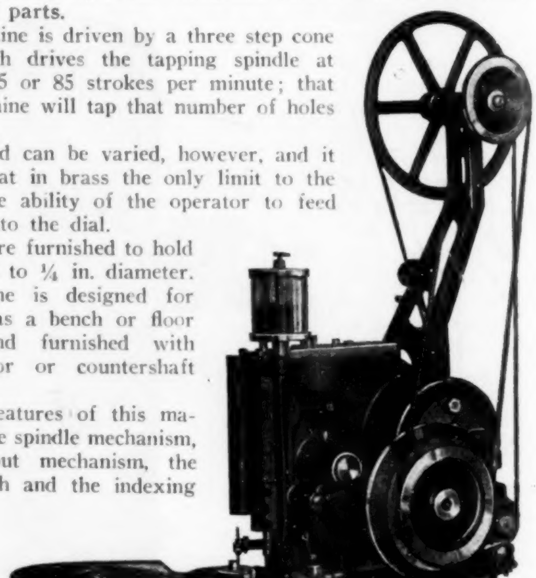
The machine is driven by a three step cone pulley which drives the tapping spindle at either 45, 65 or 85 strokes per minute; that is, the machine will tap that number of holes per minute.

This speed can be varied, however, and it is stated that in brass the only limit to the speed is the ability of the operator to feed the parts into the dial.

Collects are furnished to hold taps from 0 to ¼ in. diameter. The machine is designed for use either as a bench or floor machine and furnished with either motor or countershaft drive.

Special features of this machine are the spindle mechanism, the knockout mechanism, the safety clutch and the indexing device.

Shipping weight, with complete set of wrenches, chucks, bland dial, countershaft, etc., 440 lbs.



H. & H. TAPPING MACHINE.

## PATTERN LETTERS AND FIGURES

H. W. Knight & Son of Seneca Falls, New York, are manufacturers of pattern letters and figures. They have made up a sample board containing 25 different styles in half inch sizes. The purpose of this board, which will be sent on request to foundrymen and pattern makers, is to aid them in selecting styles of letters for their many uses. It will enable them to specify syles and sizes which are in stock and thus avoid delays, and in many cases, additional expense.

SAMPLE BOARD FOR PATTERN LETTERS

Styles and sizes shown are made in bronze, aluminum or white metal. They can be cast with tacks or spurs on the back, or drilled for brads. Monograms, trade marks, lettered or figured plates with raised or sunken letters are made up specially on very short notice.

## ELECTRIC MELTING POTS

An addition to the Trent line of rapid heating melting pots, made by Harold E. Trent, Philadelphia, Pa., is shown in Fig. 1. This pot is suitable for melting babbitt, solder, lead and tin, and has a capacity of 10 lbs. It is adapted for 110 and 220 volts A. C. and can be connected to a lamp socket. It will be noticed that there is a new design of protected plug contacts, whereby a standard plug can be used to obtain the three heat combination.

PORTABLE 10-LB. ELECTRIC LEAD MELTING POT

All pots are fitted with spouts and two handles to facilitate pouring metal if so desired. The crucible is insulated, affording high efficiency.

Another addition is a 45 lb. pot controlled by a three heat switch, and separable plug connection. This pot is shown in Fig. 2, and has been adapted not only for ladle and dipping work, but also for pouring, as a spout and handle are part of the standard design.

PORTABLE 45-LB. ELECTRIC LEAD MELTING POT

The pot is for use wherever solder, babbitt, tin or lead is melted.

## NEW BLACK LACQUER

The Anderson Chemical Company, 40 Rector street, New York, has announced the development of a new rubber black lacquer with a particular velvet finish. It was made primarily to adhere to aluminum and glass and on that account its adherence is exceptionally good. It is said to wear well and to withstand the humid conditions of summer exceptionally well. It is particularly adapted to metal surfaces where good adhesion and good wear are essential.

The Anderson Chemical Company is a division of the Merrimac Chemical Company, 148 State street, Boston, Mass.

## EQUIPMENT AND SUPPLY CATALOGS

**Air Filter.** American Blower Company, Detroit, Mich.

**Strip Machinery.** Blake and Johnson Company, Waterbury, Conn.

**Waste Heat Steam Generator.** La Mont Corporation, New York.

**Gas Analysis Equipment.** Charles Engelhard, Inc., New York.

**Rolling Doors.** Cornell Iron Works, Inc., Long Island, City, N. Y.

**Extraction of Iron.** Dings Magnetic Separator Company, Milwaukee, Wis.

**Half a Billion a Year Fire Loss.** Portland Cement Association, Chicago, Ill.

**Acid-Copper Analytical Set.** La Motte Chemical Products Company, Baltimore, Md.

**A Dictionary for Scientific Washing.** Cowles Detergent Company, Cleveland, Ohio.

**Recording Voltmeters.** Catalog No. 1502. The Bristol Company, Waterbury, Conn.

**S-Elastic Bakelite Bonded Grinding Wheels.** Abrasive Company, Philadelphia, Pa.

**Spectrographs and Spectrographic Equipment.** Adam Hilger, Ltd., London, England.

**Trulime.** A Vienna lime composition. Hanson and Van Winkle Company, Newark, N. J.

**Sharing Profits with Employees.** Policyholder's Service Bureau, Metropolitan Life Insurance Company.

**Benjamin Reflector.** A house organ published by the Benjamin Electric Manufacturing Company, Chicago, Ill.

**Automatic Arc Welding with Lincoln "Stable-Arc" Automatics.** Lincoln Electric Company, Cleveland, Ohio.

**The Last Word in Sanitation**—Bridgeport-Keating Flush Valve. Bridgeport Brass Company, Bridgeport, Conn.

**Wavelength Spectrometers, Monochromators and Specialized Spectroscopes.** Adam Hilger, Ltd., London, England.

**Year Book of the Merchants' Association,** New York. The 1926 edition of this annual volume describing the activities of this association.

**Pure Nickel and "Nickoware" Kitchen Utensils.** The last named consists of seamless hard drawn sheet nickel covered with a heavy copper.

**"How to Make an Inexpensive Storage Oven for Plumbago Crucibles."** Plumbago Crucible Manufacturers' Publicity Bureau, New York.

**"What Is Back of the Sand Cutter You Buy or Lease?"** By V. E. Minich, president, American Foundry Equipment Company, Mishawaka, Ind.

**Standard and Special Gang Slitting Machines for Slitting and Trimming Sheet Metal.** Waterbury Farrel Foundry & Machine Company, Waterbury, Conn.

**Hand Book 1926-1927.** Artistic Lighting Equipment Association, Cleveland, Ohio. This booklet explains what the association is, what it does and what it costs.

**General Electric Publications.** Motorized Power, Fitted to Every Need; Control Equipment for Charging Storage Batteries. General Electric Company, Schenectady, N. Y.

**Lead Base Babbitting.** Folder 4474, describing the babbitting of bearings and explaining the use of the Westinghouse Automatic Electric Babbitting Pots. Westinghouse

Electric and Manufacturing Company, East Pittsburgh, Pa. It describes also the lead base babbitt, alloy No. 25, a product of the Westinghouse Company.

**Economics for Workers.** A special interview with Carl F. Dietz, president of the Bridgeport Brass Company, Bridgeport, Conn., published by the Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York. The material in this interview is very similar to that published in THE METAL INDUSTRY for August, 1925, page 320 in the history and activities of the Bridgeport Brass Company.

**Industrial Research Laboratories in the United States.** Bulletin No. 16 of the National Research Council, Washington, D. C. (issued in 1921). Since 1921 a large number of industrial concerns have established research laboratories. It is also probably true that the 1921 list does not contain a complete roster of the firms which had laboratories at that time. In order that the new list may be as complete as possible the council asks the readers of THE METAL INDUSTRY who are connected with firms now maintaining research laboratories to send a post-card giving the name and address of the firms with which they are connected. Questionnaires will then be sent to these firms. Address post-card to the Research Information Service, National Research Council, B & 21st streets, Washington, D. C.

# ASSOCIATIONS and SOCIETIES

**REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS**

## AMERICAN ELECTRO PLATERS' SOCIETY

### NEW YORK BRANCH

HEADQUARTERS, c/o J. F. STERLING, 2595 45th ST., ASTORIA, L. I.

The New York Branch of the American Electro-Platers' Society held its regular meetings at the World Building, Park Row, New York, October 8 and 22, 1926. Both meetings were very well attended.

At the first meeting, verde antique finishes on bronze, brass and plated ware were discussed, and quite a few different methods were outlined by the members. Mr. Beck gave an interesting description of the method of making genuine verde antique in his plant. At the second meeting gold solutions were discussed.

The committee on the Invitation Meeting to be held December 9, 1926, reported that an excellent program was being arranged.

### PHILADELPHIA BRANCH

HEADQUARTERS, c/o PHILIP UHL, 2432 N. 29th STREET

The Twelfth Annual Meeting and Banquet of the Philadelphia branch of the American Electro-Platers' Society will be held in Mosebach's Hall, on Girard avenue and 13th street, Philadelphia, Pa., on Saturday, November 20, 1926.

The educational sessions will start at 3 p. m., in charge of Willard M. Scott of the U. S. Arsenal, Frankford, Philadelphia. The following speakers will present papers:

**Charles H. Proctor,** founder of the society and plating-chemical editor of THE METAL INDUSTRY.

**Dr. H. Lukens,** University of Pennsylvania.

**Dr. Wm. Blum,** Bureau of Standards.

**F. C. Mesle,** president of the American Electro-Platers' Society.

**George B. Hogaboom,** Newark branch, A. E. S.

A cordial invitation is extended to all interested in electroplating and electro-chemistry to attend this meeting and banquet. The meeting will be free and open to everyone. Banquet tickets will cost $3.

## COPPER AND BRASS ASSOCIATION

HEADQUARTERS, 25 BROADWAY, NEW YORK

The sixth annual meeting of the Copper and Brass Research Association was held October 14, 1926, at its offices, 25 Broadway, New York City. R. L. Agassiz, president of the Calumet & Hecla Consolidated Copper Company, was re-elected president.

The following were among those elected members of the board of directors:

John A. Coe, president—American Brass Company.

F. S. Chase, president—Chase Companies, Inc.

Edward H. Binns, president—C. G. Hussey & Company.

H. J. Rowland, secretary and sales manager—Rome Brass and Copper Company.

Henry F. Bassett, president—Taunton-New Bedford Copper Company.

Carl F. Dietz, president—Bridgeport Brass Company.

B. Goldsmith, president—National Brass & Copper Company.

E. O. Goss, president—Scovill Manufacturing Company.

J. M. Jones, president—Baltimore Tube Company.

J. R. Van Brunt, president—U. T. Hungerford Brass & Copper Company.

At a meeting of the board of directors the fallowing officers were elected: President, R. L. Agassiz; vice-presidents, C. F. Kelley, F. S. Chase, Walter Douglas and H. J. Rowland; treasurer, Stephen Birch; secretary, H. H. R. Spofford; manager, W. A. Willis.

H. H. R. Spofford, Harvard 1911, who for the past four years has been a mechanical engineer in the research department of the association, was elected secretary to fill the vacancy caused by the resignation of George A. Sloan, Mr. Sloan resigned to become secretary of the Cotton-Textile Institute, Inc., and his resignation becomes effective November 1.

The following are among the new members admitted to membership during the year: Baltimore Tube Company, Baltimore, Md.; Wheeler Condenser & Engineering Company, New York; Mueller Company, Decatur, Ill.

## NATIONAL FOUNDERS' ASSOCIATION

HEADQUARTERS, 29 S. LA SALLE STREET, CHICAGO, ILL.

The 30th Annual Convention of the National Founders' Association, will be held at the Hotel Astor, November 17 and 18, 1926. The usual annual meeting of the Administrative Council will be held Tuesday, November 16 at 10 a. m., and the Alumni Dinner for past officers, Tuesday, November 16, at 7 p. m. at the above place. The program includes the following.

Report of Committee on Industrial Education. L. W. Olson, Works Manager, Ohio Brass Company, Mansfield, Ohio.

Education for Work. L. A. Hartley, Director Industrial Education.

The Patent System: What It Means to Industry and How It May Be Improved. Honorable Thomas E. Robertson, Commissioner of Patents, Washington, D. C.

Practical Business Applications of Economic Studies. M. C. Rorty, Vice-President International Telephone & Telegraph Company, New York.

Natural Light and Ventilation in the Foundry. Clark P. Pond. Vice-President, Engineering Sales, David Lupton's Sons Company, Philadelphia, Pa.

Artificial Lighting in Foundries. W. H. Rademacher, Edison Lamp Works, General Electric Company, Harrison, N. J.

Why the Practical Foundry Cost Method Pays Dividends. E. T. Runge, Cleveland, Ohio.

The Elimination of Waste in Industry. R. M. Hudson, Chief, Division of Simplified Practice, Department of Commerce, Washington, D. C.

## LIGHTING EQUIPMENT ASSOCIATION

HEADQUARTERS, GUARANTEE TITLE BLDG., CLEVELAND, OHIO

The Artistic Lighting Equipment Association will hold a yearly national exposition in various cities throughout the United States, the first to be in Cleveland, Ohio, of modern lighting equipment and high quality parts and supplies. The purpose of this exhibit is to raise a standard of design, quality and finish of workmanship in all types of lighting equipment,

increase the use of better parts and supplies, promote the replacement of old and obsolete fixtures now in use with more modern equipment, and devote more thought to its artistic and decorative effect on the surroundings. These exhibitions will be attended by buyers, manufacturers, dealers, jobbers, electrical contractors, architects, builders and general public.

Information can be obtained from the secretary of the association at the above address.

# Personals

## FRANK B. PARSONS

Frank B. Parsons, whose reminiscences in the electroplating industry as carried on by the Scovill Manufacturing Company of Waterbury, Conn., will be found on page 462 of this issue, was born in Waterbury, in 1861. Mr. Parsons attended the public schools of that city and on February 10, 1875, obtained his first employment in the button department of the Scovill Manufacturing Company. His first job was stringing work.

FRANK B. PARSONS.

Mr. Parsons continued to work in the button department in various capacities until 1895 when he was placed in charge of the dip room of the button department.

Mr. Parsons retained this position until February 10, 1920, when he ended his active service with the Scovill Manufacturing Company, after a period of 45 years. Although retired, he is still interested in the electro-plating industry which may be noted from the reminiscences mentioned above.

## E. A. SPERRY RECEIVES FRITZ MEDAL

October 15, 1926, the John Fritz Gold Medal for 1927 was awarded to Elmer Ambrose Sperry of New York, for the development of the gyro-compass and the application of the gyroscope to the stabilization of ships and aeroplanes. This annual award was made unanimously by the board of sixteen representatives of the American societies of civil, mining and metallurgical, mechanical and electrical engineers, having an aggregate membership of 56,000.

This medal is awarded not oftener than once a year for notable scientific or industrial achievement, without restriction on account of nationality or sex. It is a memorial to John Fritz, late of Bethlehem, Pa., long a leader in the American iron and steel industry.

This is the 23rd award. The first was to John Fritz in 1902 in celebration of his eightieth birthday. A few of the other medalists are Lord Kelvin, George Westinghouse, Alexander Graham Bell, Charles T. Porter, Alfred Noble, James Douglas and Henry M. Howe.

Mr. Sperry is an engineer and inventor, born in Cortland, N. Y., October 12, 1860. His activities have made him one of the most important producers of metal products in the United States. Among his inventions are the electric arc light, electrical mining machinery, street railway cars, electrical automobiles, a process for producing caustic soda and bleach, storage batteries and a process for producing white lead from copper mining wastes. The achievement for which he is best known, however, is the successful practical application of the gyroscope in the gyro-compass and gyroscopic stabilizer for ships and airplanes. He has also developed internal combustion engines of which his most important work was a compound Diesel engine.

Mr. Sperry is a charter member and founder of the American Institute of Electrical Engineers and the American Electrochemical Society, a member of the American Society of Mechanical Engineers, American Chemical Society, Society of Naval Architects and Marine Engineers, Society of Automotive Engineers and many others. He has received numerous awards.

---

**John L. Christie**, chief metallurgist and head of the Research Department of the Bridgeport Brass Company, Bridgeport, Conn., gave a talk before the Waterbury branch of the American Electroplaters Society on November 12, 1926, on the subject of "Plating Problems."

**Professor William M. Guertler**, director of the Metall-Institute of the Charlottenburg Polytechnic, is giving a series of lectures in this country on non-ferrous metals. A statement of his itinerary can be obtained from W. M. Corse, 810 Eighteenth street, Washington, D. C.

**C. W. Sproull**, of the firm of manufacturers' representatives, Allen, Sproull and Allen, of Fort Worth, Texas, recently visited Bridgeport to complete arrangements to represent the Bridgeport Brass Company in the southwest, for the sale of the Bridgeport line of plumbing goods, Plumrite brass pipe and fittings and Bridgeport-Keating flush valves.

**Evan J. Parker**, formerly of the Morgan Engineering Works, Alliance, Ohio, has joined the forces of the Northern Engineering Works, Detroit, Mich., makers of the Northern line of material handling equipment such as electric and hand cranes, electric and air hoists, foundry equipment, etc. Mr. Parker will have charge of the sales promotion division.

**J. E. MacArthur**, has been appointed general manager of the Abbott Ball Company, Hartford, Conn., maker of steel, brass and bronze bearing balls. He was formerly works manager for the Russell Motor Company, Inc., Buffalo, and previously connected with the Brown & Sharpe Manufacturing Company, Providence, R. I., and the Pierce Arrow Motor Car Company, Buffalo.

**J. R. Brandt** has joined the Cleveland office of the Bridgeport Brass Company, located at 2017 Superior Viaduct, as raw material salesman in the Pittsburgh territory and parts of Ohio. Before coming with the brass company, Mr. Brandt had experience with the following companies: U. S. Copper Products Corporation, Rome Hollow Wire and Tube Company, Hennig Nickel Rolling Mills.

# Obituaries

## HOWARD L. FRANKLIN

Howard L. Franklin, 69, president of the Franklin Die-Casting Corporation, brother of Herbert H. Franklin, president of the H. H. Franklin Manufacturing Company, died suddenly at 4 o'clock Saturday, October 16, when stricken while playing golf on Bellevue Country Club course. Mr. Franklin had been president of the die-casting corporation since November, 1919, when it was separated from the H. H. Franklin Manufacturing Company and incorporated as a separate unit.

He had been actively connected with the die-casting industry since 1898 when he joined his brother Herbert H. Franklin in the development of this new line of industry. In addition to being president of the Franklin Die-Casting Corporation, he was at the time of his death a director of the H. H. Franklin Manufacturing Company and the Liberty National Bank of Syracuse, New York.

# NEWS OF THE INDUSTRY

## BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

### WATERBURY, CONN.

NOVEMBER 1, 1926

Seven local brass concerns were honored at the American institute exposition at 104th Field Artillery armory in New York city, last month. The honors were bestowed on those firms to whom awards had been given by the institute prior to 50 years ago. Firms in but eight cities were so honored, four of them being in Connecticut. Waterbury led all the cities in the greatest number of awards prior to that date. At last month's exposition honorary fellowships in the institute were bestowed on the representatives of the seven local firms.

The firms so honored were: **Benedict & Burnham,** now part of the **American Brass Company,** given an award in 1834; **Scovill Manufacturing Company,** given an award in 1834; **Waterbury Button Company,** 1850; **Waterbury Brass Company,** now part of the **American Brass Company,** given award in 1851; **Blake & Johnson,** 1856; **American Ring Company,** 1857; **Steele & Johnson,** 1866, and the **E. J. Manville Machine Company,** 1875. **LeRoy M. Gibbs** of this city acted as special representative of the Chamber of Commerce at the institute's exposition, spoke on the increase in the use of brass and Waterbury's part in it.

Based on production for the three-quarters of the year ending Sept. 30, this will be the biggest year in the history of the **American Brass Company.** If production continues on an average equal to the first nine months, the production for 1926 will be 685,000,000 pounds of fabricated copper and brass products. This exceeds the 1925 production by 32 million pounds; the 1924 production by 166 million pounds; the 1923 production by 180 million pounds, and the 1922 production by 273 million pounds. This production by the American Brass mills added to the production of Anaconda's Great Falls mills will give the parent company an annual product of close to one million pounds of finished material for 1926. President **John A. Coe** of the American Brass Company has given confirmation to these figures.

The **Manufacturers' Association of Connecticut** held its annual meeting and banquet here Sept. 29. Assistant Secretary of War **Hanford MacNider** spoke, coming here by plane. He explained the department's preparedness program which the manufacturers of this region are asked to adopt. Major-General **John F. O'Ryan,** former commander of the 27th division, Congressman **John Q. Tilson,** House Leader, Governor **John H. Trumbull** and Senator **Hiram,** also spoke. **W. R. Webster,** vice-president of the **Bridgeport Brass Company,** chairman of the committee of the association which has been working in conjunction with the war department on the industrial preparedness program. **John H. Goss** of the **Scovill Company** is on the committee. The program involves assigning to certain factories in each district the responsibility for producing and supplying certain specified articles for the forces raised in that district in time of war.

The model home now being built by a local newspaper, has been equipped with bathroom fixtures manufactured by the **American Pin Company.** They are of heavy chromium plate and guaranteed not to tarnish or peel. One of the features is a curtainless shower.

The **Belding-Heminway Company** of Watertown has issued the following statement: "It has been rumored that the dividend on Belding-Heminway Company common stock is to be cut. The president of the company states that he does not anticipate any change in the rate of dividend, that the condition of the company is excellent and that the earnings under present conditions continue to be satisfactory. Attention is called to the fact that the company is continuing to earn in excess of its dividend requirements during a period in which most other companies of a similar nature have lost money."

**William Henry Latham,** 65 years of age, of 94 Ives street, died at the plant of the Waterbury Manufacturing Company, Oct. 12, where he had been employed for 25 years. Death resulted from a sudden heart attack, no one being near when he died. He is survived by his wife, a son, William T. Latham of Mauch Chunk, Penn., and a daughter, Shirley, of New York city.

Employes of the **Platt Brothers Company** held a clambake, Oct. 2, at Boulder Grove. The guests of honor were **Roland H. Camp, Lewis J. Hart** and **Franklin R. White,** officers of the company.—W. R. B.

### BRIDGEPORT, CONN.

NOVEMBER 1, 1926

**Frederick D. Baker,** former local manufacturer and capitalist, former health commissioner, fire commissioner and police commissioner, died Oct. 23 at his home on Barnum avenue at the age of 73. He was one of the three men who early saw the possibilities in the Weed anti-skid chain and with **Walter B. Lasher** and Col. **H. D. Weed,** formed the **Weed Chain Tire Grip Company.** Earlier in his life he worked in the brass mill of the **Holmes & Griggs Manufacturing Company,** coming to Bridgeport in 1881 and entering the employ of what is now the **Holmes & Edwards** plant of the **International Silver Company,** later becoming superintendent of the factory. He later became salesman, then director and finally vice-president of the **Acme Shear Company,** which position he held at his death.

**Carl F. Dietz,** president and general manager of the **Bridgeport Brass Company,** addressed the members of the **Rotary Club** at the Stratfield, Oct. 19, on the functions and ethical practices of the purchasing agent, emphasizing the point that unless the buyer and the seller are both benefited in a business transaction, no real good can result to either party.

Industrial activity in Bridgeport is on an upward trend according to a report just issued by the **Manufacturers' Association.** The report indicates that local factories are employing more persons at present than at any other time since last spring. Bridgeport factories are running 82 per cent normal from the standpoint of the number of employes, and the average number of hours worked per employe a week has been going up each week for the past three months. The average hours worked per man for the week ending Oct. 2 was 51.6. At present there are about 14,000 persons employed in Bridgeport factories. It is estimated that 17,000 is the number normally employed.—W. R. B.

### TORRINGTON, CONN.

NOVEMBER 1, 1926

Torrington factories are working full time, the labor situation is good with plenty of work for everybody, and the outlook for the future is bright.

Additions to the **Fitzgerald, Torrington Specialty** and **Progressive** plants are nearing completion.

The big new addition to the Torrington branch of the **American Brass Company,** now nearing completion, will involve an aggregate expenditure of close to half a million dollars, according to information secured by THE METAL INDUSTRY representative. The American Brass Company, it is reported, is considering the installation of automatic telegraph printing machines between its branches in Connecticut. Heretofore communication between the plants has been largely by telephone.

**Thomas W. Bryant** of the **Union Hardware Company** has returned from a trip to England.

**George H. Braman,** of the **American Brass Company,** has sold his estate on Migeon avenue to the North Shore Properties Company, which has announced that it will use the property as a site for several up-to-date apartment houses.—J. H. T.

### NEW BRITAIN, CONN.

NOVEMBER 1, 1926

Starting Monday, October 25, the entire plant of the **New Departure Manufacturing Company** in Bristol went into a curtailed working schedule of eight hours a day and a five day week. The management, in making the announcement, said that the cut in working hours has been necessitated by a material decline in business and it was necessary to curtail either hours or employes. Following a special meeting, the management decided that it would be better to cut the working hours of the entire night and day shift, thus affording steady employment for all, rather than cut down on the working personnel and force many employes out of work. The New Departure Manufacturing Company is a branch of the General **Motors Corporation** and among other things makes vast quantities of roller bearings.

Thus far, this is the only plant in this section that has either announced a change in working hours or admitted a slump in business.

Here in New Britain all of the factories are working on regular schedules and there are departments that are working overtime. This especially is true at **Landers, Frary & Clark,** where there is an unusually early demand for household appliances, both electrical and metal. Ordinarily, this demand is very brisk just before the Christmas holidays, but this season it has started several weeks earlier.

At the **Stanley Works** there seems to be a noticeable decline in the export business, but since this firm now has factories of its own in Europe, this undoubtedly accounts for some of the loss. Domestic trade seems to be running true to the season.

The **P. and F. Corbin Branch** of the **American Hardware Corporation** shows no signs of a let-up nor does the **Corbin Screw Corporation** or the **Russell** and **Erwin Division.**

The **New Britain Machine Company** too, seems to be getting along very nicely and encouraging business reports are heard there.

Despite the rather pessimistic report from Bristol, manufacturing officials here do not look for any material slump this winter.—H. R. J.

## MIDDLE ATLANTIC STATES

### ROCHESTER, N. Y.

NOVEMBER 1, 1926

The past month has seen but very little change in the business situation so far as the metal industry is concerned. In one or two plants, however, activities are running high, owing to an unusual demand for their products.

Indications point to a fairly good increase in business activities following election, although it is declared that very little in the way of orders is being delayed or figured as being dependent upon the results of the coming elections. Recent published accounts of suggested or proposed industrial departures in European fields have not affected the Rochester manufacturing market to any extent. Much more material is going to South American ports than to Europe from this city, especially during the past six months.

Local purchasing agents report that a much larger volume of supplies of copper, brass, aluminum and zinc has been brought into Rochester warehouse since June 1st than in recent years, in anticipation of a brisk winter season. Inquiry has developed the information that many of the larger plants about the city have orders booked as far ahead as January 15th, and that work on December deliveries has been proceeding since August.

It is a fact that fewer mechanics, metal polishers and the like are out of employment at this than a year ago.—G. B. E.

### NEWARK, N. J.

NOVEMBER 1, 1926

The following Newark concerns have been chartered: **Norton Smelting and Refining Corporation,** smelting and refining of metal, $25,000; **Rankin Foundry Company, Inc.,** 1,000 shares no par, conduct foundry; **Abwill Manufacturing Company,** manufacture lighting equipment, $125,000; **Diana Manufacturing Company,** manufacture radio supplies, $100,000; **Interstate Service Corporation,** electrical supplies, $50,000.

James C. Coleman, of 331 Thirteenth avenue, Newark, N. J., well known in the metal world, died recently at his home. He was born in Trenton, N. J., in 1844, and went to Newark in 1876. Mr. Coleman was employed for twenty-seven years by T. B. Peddie & Company. Later he engaged in the manufacture of aluminum wares. He was a founder in 1892 and later became president of the New Jersey Aluminum Company.

In 1912 Mr. Coleman and Gustav A. Kruttschnitt, president of the Irvington Board of Education, who was associated with him, sold their interests in the aluminum company and purchased an interest in the National Metal Stamping & Manufacturing Company in Newark. Mr. Coleman retired from active business in 1917. Mr. Coleman was a member of the advisory board of the Baptist Home and treasurer of the Peddie Institute for Boys at Hightstown. He is survived by his widow and one son.—C. A. L.

### TRENTON, N. J.

NOVEMBER 1, 1926

Trenton metal industries continue to prosper and some of the manufacturers report the outlook as being very good The **Jordan L. Mott Company** is doing nicely under a receivership and it is believed that the two receivers will shortly be discharged from their duties. The receivers put the plant on a good paying business. The **Trenton Emblem Company** has enough orders on hand to continue operating full time during the winter. The **Westinghouse Lamp Company** is also busy.

Payment of employes by checks has been inaugurated by the **Westinghouse Lamp Company** as a result of a $15,000 payroll robbery here recently. **William C. Hipple,** manager of the plant, asserted that his action in resorting to checks for wage payments was taken to protect employes from possible injury. Heretofore the payroll had been delivered to the plant by armored car and had been insured against loss by theft.

The **John A. Roebling's Sons Company** has been honored by being awarded a gold medal by the American Institute of New York. An award had been made as far back as 1846 for wire rope. A short time ago the Roebling Company was awarded an honorary degree of fellowship in this institute.

The Court of Chancery has confirmed the sale of the **Trenton Hardware Company** to **John Paley,** who will continue the business. This company, which went into the hands of receivers some time ago, was organized nearly 100 years ago.

Following concerns have been incorporated here: **Monarch Production Company,** Shrewsbury, manufacture radio parts, $125,000; **White Manufacturing Company,** Trenton, radio parts, $120,000; **Kielhorn-Godfrey, Inc.,** lighting fixtures, Camden, 5,000 shares; **Union Electric Construction & Equipment,** Atlantic City, electrical equipment, $100,000; **New Jersey Oil Heat Corporation,** Morris Plains, manufacture oil heaters, $125,000; **Camden Storage Battery Company,** Camden, storage batteries, 2,500 shares; **Lafayette Manufacturing Company,** metal articles, Jersey City, $100,000; **Victor Metal Works, Inc.,** Long Branch, deal in metal products, $50,000; **C. and W. Lamp Manufacturing Company,** Jersey City, manufacture lamps, $75,000; **Marmon Electrical Manufacturing Company,** Linden, electrical supplies, 100 shares no par.—C. A. L.

### PITTSBURGH, PA.

NOVEMBER 1, 1926

General trade as a whole in Pittsburgh district is fair.

Hardware is moving in fair volume; jewelry is in greater demand, particularly for holiday trade. Operations of industrial plants are on broader schedules, and iron and steel plants report orders at a slightly higher rate this month. Manufacturers of electrical merchandise are quite busy. Radio equipment is in greater demand, as the season advances. Larger sales of plumbing and heating equipment are reported.

September business is ahead of last year and wholesale prices are higher than in August. The volume of business through the second week in October was still above a year ago, as measured by check payments, according to the weekly statement of the Department of Commerce. The distribution of goods as seen from data on car loadings showed similar gains over last year. Building contracts awarded were larger than in either the previous week or the same week of last year. Wholesale prices averaged higher than in the previous week, but were still below a year ago.—H. W. R.

## MIDDLE WESTERN STATES

### DETROIT, MICH.

NOVEMBER 1, 1926

The **National Smelting & Refining Company,** at Detroit, is about to erect two factory buildings costing $100,000. The architects are **Murphy & Burns.**

Damage estimated at about $150,000 was caused recently by a fire, which destroyed two enameling ovens at the **Pontiac** plant of the **Oakland Motor Car Company.**

The **C. M. Hall Lamp Company,** manufacturer of automobile lamps and illuminating devices, it is stated, will soon move its Kenosha, Wis., plant to Detroit, in order to centralize production with the **Edmund & Jones Company** of Detroit, which purchased its holdings in Kenosha.

The **Peninsular Stove Company,** it is announced, has acquired 18½ acres in Brightmoor, a suburb of Detroit, on which it will erect a most modern and compeltely equipped stove works. Practically all of the company's present holdings at Fort street and Trumbull avenues in Detroit, were recently purchased by the Michigan Central Railroad for approximately $2,500,000, to be used as freight yards. According to **Alfred B. Moran,** secretary of the stove organization, construction of the buildings will be started at once, and he expects they will be ready for occupancy about January 1, 1928.

**Charles W. Eggenweiler, Harry W. Holt** and **William T. Bohn** are the three new vice-presidents of the **Bohn Aluminum & Brass Corporation** of Detroit.

The largest order in the history of the company, in point of number of pieces involved, and the second largest order in point of value, was received recently by the **Mueller Brass Company** of Port Huron. The order has a value of $400,000 and calls for 36,000,000 pieces. The finishing work on this order, exclusive of rod work and casting, will require the operation of 13 machines 24 hours a day for one year, says **Oscar B. Mueller,** president of the plant. Speaking of conditions at the plant, he said that shipments to date this year have exceeded those of the previous year by 35 per cent, and that there were more than $1,000,000 of unfilled orders on the company's books.

The **Superior Radiator Shield & Enameling Company,** Detroit, announces a change of name to **Superior Radiator Shield Company.**—F. J. H.

### CHICAGO, ILL.

NOVEMBER 1, 1926

The following corporations have been granted charters by the Secretary of State:

**Coon, Peoria and Company,** 116 South Adams street, Peoria, with a capitalization of $55,000, will manufacture and deal in musical instruments of all kinds. Incorporators: W. C. Leavitt, Effie Leavitt, Homer McWayne. Correspondent, W. C. Barrett, 321 Main street, Peoria, Illinois.

**Fassig-Weer Motor Company,** 1210-12 State street, East St. Louis. Capital 200 non par value. They will manufacture and deal in automobile supplies, automobiles and machinery. Incorporators: Kenneth J. Waber, M. Paul Murray, Russell R. Fassig. Correspondent, Case, Volys & Stemmler, Blatman's Bank, St. Louis.

**Capital Manufacturing Company,** 5850 Racine avenue, Chicago, are capitalized for $25,000. They will manufacture and deal in electrical devices, supplies and apparatus of all kinds. Incorporators: Henry J. Grieshaber, Henry L. Vogel, George A. Grieshaber. Correspondent, George J. Irving, 2927 S. Loomis street.

**Peerless Construction Company,** 3111 Kolmar street, Chicago, are capitalized for $20,000, to manufacture and deal in metal novelties, hardware and construction materials, etc. Incorporators: Hilda C. Lindal, B. J. Lindal, Kjartan Vigfusson. Correspondent, Fisher, Boyden, Kales & Bell, 134 South La Salle street, Chicago.

**Temme Spring Corporation,** 55-57 East 28th street, Chicago. Capital, $25,000 and 250 shares non par value. To manufacture and deal in automobile supplies and accessories. Incorporators: Walter C. Maun, Leo S. Marcmont, Herman G. Kastilahn. Correspondent, Wolfsohn & Fireman, 110 South Dearborn.

**Public Radio Service, Inc.,** 66 East South Water street, Chicago. Capital $40,000. To manufacture and deal in radios and radio equipment and all kinds of machinery and electrical devices. Incorporators: J. C. Ruff, L. L. Martel, William F. Rankin. Correspondent, Benjamin F. Goldstein, Otia building.

**Perfection Dental Specialties Company,** 213 North Morgan street, Chicago. Capital $1,500. To manufacture and deal in dental and surgical instruments. Incorporators: J. R. Wilk, D. H. Daskal, David Davis. Correspondent, Archie H. Cohen, 160 North La Salle street, Chicago.—L. H. G.

## OTHER COUNTRIES

### BIRMINGHAM, ENGLAND

OCTOBER 18, 1926.

Very great encouragement has been given in the silver and electroplate trades by an autumn revival, which promises to yield better business for the Christmas season than has been met with for some years. It is already becoming doubtful whether the orders on hand can be executed within the required time. Many firms are making full time, and several are increasing their capacity. There are signs that the stocks held by shopkeepers have become very low, and are in urgent need of renewal. The demand has set in somewhat earlier than usual, and, one manufacturer of electroplate has doubled his output within the past two months. Prices are rather low, owing to the necessity of meeting the keen home and foreign competition. It is believed, however, that the tide has turned in the jewelry and electroplate industries, and that, when the end of the strike brings normal conditions, steady recovery may be expected. One effect of the improved demand for gold and silver is that the refiners of Birmingham are busier than they have been for a long time past.

The scarcity of fuel has been a most serious result of the strike to many makers of brass, bronze, copper and other tubes. To some extent oil has been introduced experimentally for heating and annealing purposes, one firm, for example, having installed eight furnaces, but oil is admittedly more expensive than coal, and its use is somewhat uneconomical, because, in many cases, the furnaces were not originally designed for oil burning.

It is remarkable that so little change has been made in the prices of copper tubes. A strongly conservative policy under this head has been maintained owing to the keenness of continental demand. But the price of copper has been considered very moderate, and there are very few complaints to make under this head. The great deficiency in the copper tube trade is that relating to shipbuilding equipment, which still leaves much to be desired.

Domestic demand for copper for water conveyance has been a great windfall for the trade, makers expressing very much appreciation of the work of the special committee established some time ago to discover new uses for copper. The copper water tube has been a kind of discovery and big business is in sight which it is expected will necessitate increased capacity at some of the works. This is a line in which prices are cut to the finest degree, chiefly because Germany is fully aware of the menace offered by British development. The British

makers frankly admit that they have taken a leaf out of Mr. Ford's book, and the policy will be as demand increases to concede a corresponding reduction in price, makers depending for their return upon the larger output. Eventually, the domestic water tube will be, it is predicted, a very big Birmingham business.

For condenser tubing larger use appears to be made of cupro-nickel, a mixture containing 20 per cent of this alloy, although many experienced makers believe that the older metals give all the resistance required to corrosive influences, and the bulk of the work is therefore produced in 70/30 brass or 70/29 with one part tin. It is believed, however, that more will be heard in future of chromium-plated tubes and fittings, this process now being carried on very successfully on commercial lines. The covering gives a wonderful resistance to tarnish. It costs about 50 per cent more than nickel but this is considered to be more than compensated for by the superior hardness and the wonderful retention of the finish.

There is some revival in the chandelier trade which has led to increased demand for tubes, and it is believed the public taste in connection with electric lighting is reverting to a preference to some kind of pendant instead of bowl lighting which makes practically no demand for metal.

Birmingham is becoming more and more a recognized center for the production of wireless apparatus. The city is at home among all the necessary metals, whatever the special alloy may be and in regard to nickel production turns out very large quantities. The various copper and tin alloys are all readily available, and there is no lack of clever craftsmen ready to apply mechanical genius to the smallest unit in connection with wireless mechanisms. At the present time the largest wireless exhibition ever opened in the city is being attended by numerous experts and users, and a number of novelties are included, indicating rapid progress.—J. H.

# Business Items—Verified

A small fire occurred in the **Standard Plating Works,** Goshen, Ind. It has not been found necessary to file any claims of damage.

The Salt Lake City office of the **Hardinge Company** is now located in the Continental Bank Building, 200 South Main street. W. L. Penick is in charge.

The **Koeppen Metal Products, Inc.**, Union City, N. J., recently incorporated, has engaged in the manufacture of cooking utensils for hotels and restaurants. This firm operates the following departments: spinning, plating, stamping, polishing.

The **Great Northern Tinning Company,** Newark, N. J., has moved from 207 Murray street into larger quarters at 62 Ferguson street and expects to be in the market for metal pots and pickling tubs. This firm operates the following departments: tinning and re-tinning.

The **National Smelting and Refining Company,** 1842 Illinois avenue, Detroit, Mich., has let contract for a new plant at Ecorse, Mich., to cost approximately $100,000 with equipment. Harry Grevnin is secretary and treasurer. This firm operates a smelting and refining department.

The **Wayne Tank and Pump Company,** Fort Wayne, Ind., has changed its name to the **Wayne Company.** This change was thought best by the board of directors on account of the diversified line that they manufacture at the present time. There has been no change in the personnel of the company.

The **Virden Company,** Ashland road and Longfellow avenue, Cleveland, Ohio, manufacturer of brass products, has placed contract with the Griffin Construction Company for an addition, 26 x 30 ft. This firm operates the following departments: brass machine shop, tool room, spinning, plating, stamping, soldering, polishing, lacquering.

The **Pangborn Corporation,** Hagerstown, Md., announces the appointment of M. I. (Dusty) Dorfan as engineer of their Dust Collecting Department, which has been extended to a specialized unit of their activities. Mr. Dorfan was formerly connected with the Allis Chalmers Manufacturing Company, and other manufacturers of dust collectors.

The **Sheet Aluminum Corporation,** Jackson, Mich., is operating a rolling mill which is turning out as a finished product, aluminum sheets, strips and coils for the utensil, automobile and allied industries. They purchase the virgin aluminum, melting, rolling and shearing the same into the above forms. Their capacity is approximately 500,000 pounds per month.

The **Adams Galvanizing Corporation** and the **Adolf Starke Company,** have consolidated under the name of the **Adams Starke Company, Inc.,** 575-583 Columbia street, Brooklyn. The company is manufacturing spikes, bolts, washers and tie rods and also is doing a jobbing business in galvanizing. A. J. Adams is secretary. This firm operates a galvanizing department.

The **Anaconda-American Brass** display at the coming exhibit of the American Electric Railway Association will include samples of the complete line of Anaconda copper, brass and bronze products, including various grades of trolley wires. Anaconda hollow conductors, high tensile strength composition cables, lead covered cables, bus bars and tubes, commutator segments, extruded shapes and die pressed parts will also be shown.

The **Eureka Pneumatic Spray Company,** 87-28-130th street, Richmond Hill, N. Y., has opened a sales and service branch at 817-819 Broadway, corner 12th street, New York, where customers may procure sprayers, accessories and parts and may also leave their repairs to be taken care of. Their truck will make daily stops, bring in repairs, attend to them and deliver to customers.

The **Botfield Refractories Company**, Philadelphia, Pa., has appointed the following distributors for Adamant fire brick cement: Westwater Supply Company, 150 N. Third street, Columbus, Ohio; Klinger-Dills Company, 129 N. Jefferson street, Dayton, Ohio; Coan Equipment Company, 236 Murray street, Ft. Wayne, Ind.; Cleveland Tool and Supply Company, 1427 W. Sixth street, Cleveland, Ohio.

The **Advance Wheel Manufacturing Company, Inc.**, 618-620 W. Lake street, Chicago, Ill., has again found it necessary to seek larger quarters with additional floor space. On August 1, 1925, they moved from 125-127 W. Illinois street to their present location. Their output has doubled the year in this location and has necessitated moving to another floor of the same building with double the space.

The **Wood Portable Fire Escape Company,** 432 Deaderick avenue, Jackson, Tenn., contemplates the installation of nickel-plating equipment at its plant. If it is decided to go ahead with these plans, they will be interested in nickel and coppering equipment, but no brass, zinc, aluminum, lead, gold, etc. Presses, lathes, drill presses, gear cutting machines, etc., together with the above mentioned plating equipment, will constitute their needs. This firm operates the following departments: galvanizing, plating, japanning, stamping, tinning, polishing.

The **Athol Pump Company,** Athol, Mass., has been purchased by the Leavitt Machine Company, Orange, Mass. The business has been in one family since 1863. A. F. Fletcher was the founder and since the death the company has been under the management of his son Edgar A. Fletcher. In addition to pumps, the company's products include plumbers' fittings. This firm operates the following departments: brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, spinning, plating, japanning, soldering, polishing, lacquering.

The **Air Reduction Company, Inc.,** New York, has acquired all the assets of the Dayton Oxygen & Hydrogen Products Company, of Dayton, Ohio, thus adding another plant to the chain of 52 plants and 169 warehouses that guarantees prompt service to Airco customers throughout the United States. The Dayton plant will furnish a new production and distributing point for the Air Reduction Sales Company to service customers in the southwestern section of Ohio with Airco high-purity oxygen and other gases used in welding and cutting. The plant went into operation under Air Reduction management October 15, 1926.

The **Short and Roehm Company,** Newark, N. J., recently organized, has leased a portion of the plant at 372 Orange street for the establishment of new works for the manufacture

of metal specialties, including signs, emblems, etc. Equipment will be installed to allow production shortly. Joseph B. Short and Richard Roehm, both formerly connected with the Whitehead and Hoag Company, Newark, manufacturer of metal novelties, will be president and vice-president respectively; Frederick Keer is secretary and treasurr. This firm operates the following departments: tool room, plating, stamping, soldering, polishing, lacquering.

The **Buckeye Products Company, Cincinnati,** Ohio, has enlarged the department for manufacturing Buckeye furnaces in order to take care of increased orders. They have opened a branch in Buffalo, which is in charge of George F. Crivel, to take care of New York State trade. They carry a full stock of all manufactured products in a warehouse in Buffalo and will supply the New York State trade by shipping direct from their Buffalo warehouse. They have established a branch in Chattanooga, Tenn., in charge of Stewart Roberts, and also have a branch in Chicago where they have a warehouse, in charge of C. J. Hamilton.

The **Matchless Metal Polish Company,** at its Chicago plant, is building a 50 x 78 ft. addition to the present factory. They are also installing a new electric elevator, a new boiler and oil burning equipment, which will operate automatically, needing no attention. They intend to use this new addition for manufacturing purposes and are changing all their kettles from belt drive to direct connected motors. These improvements will double their output and they will now be able to keep up with their orders. At their Glen Ridge, N. J., plant, improvements have also been made to facilitate handling compositions and raw materials with less labor.

**F. C. Howard** of the **Howard Foundries,** Chicago, Ill., has purchased of A. E. McLintock, the factory building erected at Oakland avenue and the Scott Lake road for the American Standard Tool Works. Mr. McLintock will erect an addition to the building for Mr. Howard and it will be operated as a branch of the Chicago foundry. Operations are to be started at once. The foundry will turn out brass, aluminum and bronze castings and manufacture wood and metal patterns. In addition much experimental work will be carried on. This firm operates the following departments: brass, bronze and aluminum foundry; brass machine shop, tool room, grinding room, plating, japanning, soldering, polishing and others.

The **Niagara Falls Smelting & Refining Corporation,** Buffalo, N. Y., has awarded to the Leach Steel Construction Corporation at Buffalo a contract for the erection of an additional 100 x 50 ft. and 24 ft. high to its main smelting plant, concrete work to Dunn Concrete Company, plumbing to Sweagles & Son, and blower construction to Carpenter Brothers of Buffalo. The company has purchased two additional surface combustion furnaces making seven of this type in operation and twenty-eight of all types working twenty-four hours per day. This makes the fourth new building constructed this year. Logeman Brothers have sold Niagara Falls Smelting and Refining Corporation, a 4 x 4 x 11 ft. hydraulic baling press.

# Industrial and Financial News

## INCORPORATIONS

The **Vulcan Metals Process Corporation,** Muncie, Ind., has been incorporated to deal in iron, steel and other metals. The incorporators are Lewellyn Jones, Walter L. Nelson, J. C. Harris and J. A. Mouch. This firm will operate the following departments: smelting and refining, casting shop, rolling mill.

Announcement is made of the formation of **Robert J. Anderson, Inc.,** to operate as a commercial testing laboratory, specializing in metals and alloys. The new laboratory, which is situated at 2416-38 Beekman street, Cincinnati, Ohio, is fully equipped for chemical analysis, mechanical testing, metallography, heat treatment and radiography. Officers of the company are Dr. Robert J. Anderson, president, H. J. Hater, treasurer, and R. T. Mesker, secretary. These, with John Eckerle and E. F. Eckerle, form the incorporators and directors. Further details will be announced later.

## WEST VIRGINIA MILL TO ROLL ALUMINUM

The Fairmont Manufacturing Company, with offices at its plant, Fairmont, W. Va., and at 52 Vanderbilt avenue, New York City, has established modern aluminum rolling mills to manufacture aluminum sheets, aluminum coils, aluminum circles, aluminum strips, aluminum body sheets and aluminum plates of every description from the very narrowest to the very widest commercial limits. This company has taken over the plant of the bankrupt West Virginia Metal Products Company which was described in THE METAL INDUSTRY for December, 1920.

The officers of the company are: William J. Adams, president and managing director; Lawrence M. Brile, vice-president and sales manager; Frank M. Brown, secretary and treasurer. The works manager is C. J. Wolfe, for many years in charge of aluminum rolling mills.

The general sales office of the company will be located at 52 Vanderbilt avenue, New York.

# Metals at the American Institute Fair

Brass in all its shapes and guises gleamed forth from the big exhibit by the Chamber of Commerce of Waterbury at the 98th Annual Fair of the American Institute in New York during the last two weeks of October. The display, which was over a hundred feet long, contained thousands of separate items, effectively displayed against a wine-colored velvet back drop. Above, a huge sign in letters cut from solid brass extended the entire length of the booth. The sign read: "Waterbury, Connecticut, the brass center of the world."

The Fair as a whole was carried out along lines which have become a tradition with the American Institute, founded in 1828.

Of exceptional interest in the Waterbury booth was a large shield on which were engraved the dates of the principal events in the history of the brass industry in Waterbury, as follows: 1790, clocks and pewter buttons, first manufactured; 1802, brass buttons; 1807, brass lamps for burning whale oil; 1812, bone and ivory buttons; 1824, sheet brass first cast and rolled locally; 1825, copper wire; 1842, copper daguerrotype plates; 1851, brass kettles; 1861, nickel blanks for U. S. Government coins; 1875, brass rods, rolled zinc and brass pins were for the first time made in America.

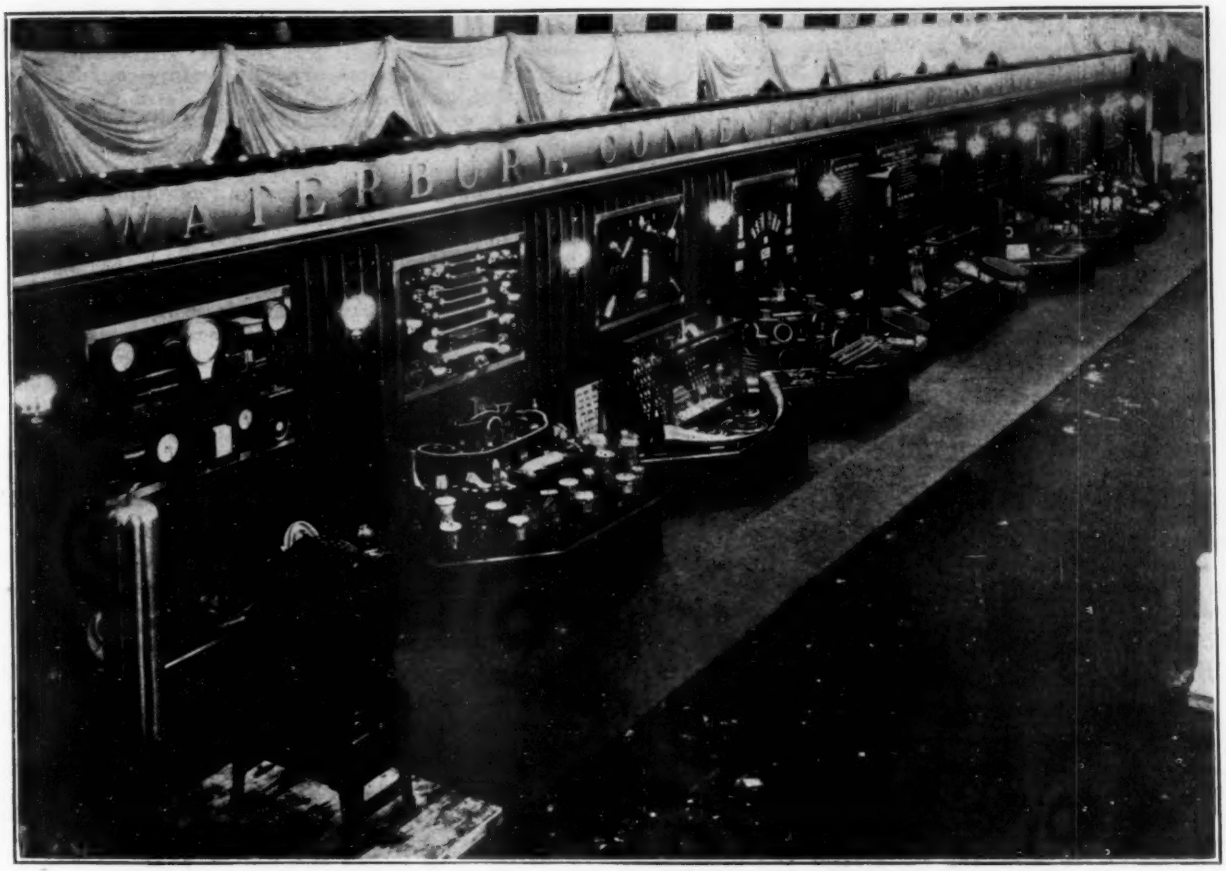
With a wealth of material on view, the general public seemed most impressed with a display showing the development of clocks and watches with samples of the first cumbersome timepieces as well as the modern type with their Westminster chimes. A coil of 1200 feet of seamless copper tubing, said to be the longest single tube in the world, attracted attention on account of its extraordinary compactness. The whole coil weighed approximately ten pounds. Other fine examples of seamless, drawn copper tubing with diameters ranging from the tiny capillary tubing to large cylinders ten inches across, were shown. Two large, seamless copper boilers—characterized by a depth of draw of 36 inches—were notable for their workmanship.

Round and hexagonal bars of all sizes were artistically arranged near the center of the exhibit. A fine display of sheet copper, brass, nickel, silver and zinc, and thin sheets of zinc rolled to five ten-thousandths of an inch in thickness and looking like silver, were in the foreground.

Miscellaneous displays in the booth included japanned zinc in

rolled sheets; brass platers' metal for plating; a display of brass buttons, illustrating workmanship from 1833 to the present; a collection of rare, old dies; a historical display of brass lamp burners; remarkable examples of die casting, including exquisite oriental bronze hinges, 12 by 20 inches and not over one-sixteenth inch in thickness; "fancy rolled brass," i.e., rolled, drawn sheeting in hammered effects; fine plumbing work in brass; ornamental

American Ring Company, Waterbury, Conn.
Ames Sword Company, Chicopee, Mass.
John Russell Cutlery Company, Turners Falls, Mass.
Ingersoll-Rand Company, New York.
Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn.
North & Judd Manufacturing Company, New Britain, Conn.


WATERBURY BOOTH AT AMERICAN INSTITUTE EXHIBITION

compacts, cigarette cases, novelties and radio parts in brass, copper and nickel; street car tokens, made of brass; and automatic gauges and equipment for practically all industrial requirements.

Honorary Fellowships were awarded to firms and organizations


HAND FORGE OVER 100 YEARS OLD, REPRESENTING THE BEGINNING OF THE METAL MANUFACTURING INDUSTRY IN NEW BRITAIN, CONN.

who had spent more than fifty years in serving the public and their products had been awarded gold medals for excellence by the Institute fifty years ago or more. Among these firms were the following:

Remington Typewriter Company, New York.
Chase Companies, Waterbury, Conn.
P. & F. Corbin, New Britain, Conn.
Russell & Erwin, New Britain, Conn.
Landers, Frary & Clark, New Britain, Conn.

Hartford, New Britain and Middletown, Conn., were also prominent at the exhibition and their products consisted largely of metals in innumerable finishes.

## METALS AT THE SESQUI-CENTENNIAL

A prospector could locate non-ferrous metals without the use of a divining rod at the Sesqui-Centennial International Exposition, now being held in Philadelphia, in celebration of the completion of a century and a half of American Independence. The visitor's eye is caught by the gleam of nickel, copper or brass everywhere if he is on the lookout for these metals.

One of the three is apparent in some form or other in many of the booths that line the long aisles of the huge exhibition palaces. Bronze, too, is very much in evidence, also aluminum. Lead, zinc and tin are to be found, likewise antimony, mercury and tungsten, and such alloys as Monel and die cast metals.

Lead played an important part in winning the country its freedom, and the card attached to a modest specimen of ore displayed in the Pennsylvania State building reminds the visitor that the lead mines of the Keystone State furnished the bullets used by the patroits in the Revolutionary War. Lead may be located in a number of exhibits at the exposition, ranging from its use in storage batteries for the electrical operation of vehicles, radio apparatus and railroads, to that of coating ferrous metal in the manufacture of certain types of burial caskets.

A comprehensive exhibit of minerals and metals found in the

United States, and a number of foreign specimens are on view in the section devoted to the Bureau of Mines in the Palace of United States Government, machinery, mining, metalurgy and transportation. There are examples in all stages, from the crude condition in which they were taken from the ground to the high finish of articles of ornament or utility.

The mining industry of Japan is illustrated by a collection of specimens of generous proportions which include zinc, copper and tungsten, as well as both precious and ferrous metals. An ingot of electrolytic tin is a feature of this exhibit.

Ornamental bronzes and brasses, antique and modern, in innumerable artistic forms find important place among the manifold exhibits from India, Ceylon, China, Japan, Egypt, Persia, Palestine, Tunis, Algiers, Spain, Austria, Hungary and other foreign countries. Rare pieces are also to be found in the Palace of Fine Arts.

To cite instances of the commercial or industrial uses of copper, brass, nickel, tin and zinc, as evidenced by exhibits at the Sesqui-Centennial International Exposition, would be to devote column after column to lists of articles including such items as model bathrooms and kitchens, fully equipped down to the last modern detail; engines, boilers, machinery of many sorts; locomotives and airplanes; gas ranges; electrical refrigerators, washing machines, dish-washers, vacuum cleaners and other household equipment; musical instruments; the telegraph, telephone and radio; business efficiency machines such as typewriters, calculators, time recorders, cash registers and similar inventions; batteries and electric wires, cables and accessories; automobile parts and accessories; and so on down an interminable line of up-to-date conveniences.

Also noticeable is the use of industrial non-ferrous metals in the manufacture of inexpensive emblematic and patriotic souvenirs which visitors buy for the consolation of the stay-at-homes unable to make the trip to the exposition.

## BUREAU OF STANDARDS ANNIVERSARY

A celebration of the twenty-fifth anniversary of the Bureau of Standard of the Department of Commerce is just announced. On Saturday, December 4, 1926, the bureau will keep open house and a banquet will be given at which the many friends of the bureau will meet the staff and reminiscenses will be exchanged, the achievements of the quarter century will be reviewed, and the present and future work will be discussed. A group of distinguished guests will attend. The event is of interest to the world of science and as well to the industrial experts who have worked so closely in cooperation with the bureau and in turn made application of its discoveries and developments in perfecting the measured control of processes. The opportunity to inspect the experimental research facilities of the bureau will be welcomed by its many friends.

## COPPER IN SMALL COINS

More than 2,000,000 pounds of copper have been required to mint $5,115,675 worth of one cent and five cent pieces, which the U. S. Treasury has turned out during the past year. This compares with an average annual production of $6,400,000 worth of minor coins containing 2,500,000 pounds of copper during the war years up to and including 1920. A pronounced increase in the output of copper coins, including the nickel, which is 75 per cent copper, is shown in figures for the past three years. A slump in the minting of these coins during 1921 and 1922 reflected the depression of that period. Demand in the latter part of 1923 for more pennies and nickels started minting activities which as yet have shown no signs of abating.

## GENERAL ELECTRIC EARNINGS

The statement of sales and net earnings for the General Electric Company for the nine months ended September 30, 1926, announced by President Gerard Swope, shows the net sales totalled $229,638,216.24 and the profit available for dividends on common stock and surplus was $30,051,619.77. This indicates net earnings equivalent to about $4.17 per share on the 7,211,481 shares of no par value common stock.

## COPPER EXPORTERS COMBINE

According to a statement by C. F. Kelly, president of the Anaconda Copper Mining Company and president of the Copper Exporters, Inc. The Copper Exporters, Inc., is an organization of American copper producers, associated with whom are certain foreign producers and sellers of copper.

The purpose of the organization is to endeavor to eliminate in foreign countries the harmful speculation that causes wide fluctuations in price, unwarranted by industrial factors in European markets, and tends to destroy confidence in the integrity of such price and the stability of the business. The operations of Copper Exporters, Inc., are entirely within the limitations fixed by the Webb act and amendments thereto, under which American producers of any commodity may join the marketing of their product in foreign markets.

Under the operation of Copper Exporters, Inc., copper prices in Europe will be established in accordance with general business conditions as they develop from day to day.

The effort will be made to sell direct to consumers except where conditions make it desirable, in facilitating export trade, to sell to distributors. An effort will be made to eliminate harmful speculation in copper.

It is the intention to keep the proper governmental authorities at all times fully advised of the operations of the association.

The respective committees are now engaged in perfecting the organization for the active transaction of business which will begin at as early a date as possible.—New York Times.

## NICKEL COMPANY STATEMENT

| | Third Quarter Sept. 30, 1926 | Nine Months Sept. 30, 1926 | Nine Months Sept. 30, 1295 |
|---|---|---|---|
| Earnings | $2,002,612.03 | $6,270,188.79 | $5,897,536.34 |
| Other Income | 41,679.64 | 127,567.70 | 138,012.82 |
| Total Income | $2,044,291.67 | $6,397,756.49 | $6,035,549.16 |
| Administration and General Expense | 127,475.79 | 406,514.96 | 375,415.47 |
| Reserved for Federal and Franchise Taxes | 193,205.29 | 670,468.13 | 588,974.63 |
| Net Operating Income | $1,723,610.59 | $5,320,773.40 | $5,071,159.06 |
| Depreciation and Depletion | 382,693.41 | 1,151,884.62 | 968,711.97 |
| Orford Works Property Expense* | 26,484.29 | 79,765.92 | 88,627.89 |
| Foreign Companies | ........ | ........ | 8,500.00 |
| Profits | $1,314,432.89 | $4,089,122.86 | $4,005,319.20 |
| Dividends, Preferred | 133,689.00 | 401,067.00 | 401,067.00 |
| Common | 836,692.00 | 2,510,076.00 | 836,692.00 |
| Balance | $ 344,051.89 | $1,177,979.86 | $2,767,560.20 |

*Insurance, taxes, etc., and pensions of ex-employees.

## METAL STOCK MARKET QUOTATIONS

| | Par | Bid | Asked |
|---|---|---|---|
| Aluminum Company of America | .. | $68 | $70 |
| American Hardware Corporation | $100 | 87 | 89 |
| Anaconda Copper | 50 | 47¾ | 47⅞ |
| Bristol Brass | 25 | 4 | 7 |
| International Nickel, com | 25 | 35½ | 35¾ |
| International Nickel, pfd | 100 | 102 | .. |
| International Silver, com | 100 | 91 | 95 |
| International Silver, pfd | 100 | 104 | 108 |
| National Enameling & Stamping | 100 | 28½ | 29½ |
| National Enameling & Stamping, pfd | 100 | 83 | 85 |
| National Lead Company, com | 100 | 150 | 152 |
| National Lead Company, pfd | 100 | 116 | 117 |
| New Jersey Zinc | 100 | 185 | 188 |
| Rome Brass & Copper | 100 | 134 | 144 |
| Scovill Manufacturing Company | .. | 255 | 260 |
| Yale & Towne Mfg. Company, new | .. | 68 | 69 |

Corrected by J. K. Rice, Jr., Co., 120 Broadway, New York.

# Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President of the Whitehead Metal Products Company of New York Inc.

NOVEMBER 1, 1926

Business in copper, brass, and white metal fabricated materials has been easy and quiet during October, with the mills running on day to day orders, and but few outstanding items of importance or volume. However, there has been only a small falling off in total tonnage in spite of this fact. It appears that the hand to mouth style of buying has been so instilled into the habits of the consumers that they persist in the practice of dividing up their purchases into a number of units, and buying frequently rather than consolidating them and placing large orders for future deliveries.

This makes for a healthy condition in the industry as by this method inventories are kept low, and the menace of large stocks in consumer's hands is completely removed. It has the effect, of course, of keeping the mill order books down to a low level, but does not effect the total volume placed over a period, so that while the mills have no great volume of orders up on their books, the daily incoming orders run to large numbers, and in the end the same total tonnage is reached.

There were two reductions each of ¼c. per pound in fabricated products of brass and copper during October. These were the result of lower prices quoted for ingot metals and are added causes for the reticent attitude on the part of buyers.

There has not been any appreciable resumption of activity by the refrigerating machine manufacturers as yet, although some of them are reported to be running on small production schedules. As the ice machine industry is one of the most important factors in the consumption of copper and Monel metal, there is considerable anxiety on the part of the fabricators of these metals, looking to the time when the important producers of electric refrigerators will have used up their stock and again come into the market with new orders. It is now believed that not much can be expected from that industry until after the first of next year.

Meanwhile, most of the other consuming factors are active, business in general is good and hardly any complaints of a very pessimistic character are heard. If the price of ingot copper takes a turn upward, it is felt that a large volume of orders would be placed for rod, sheet, tube and wire.

The general situation may be described as active without excitement or rush, and with a wide-spread feeling of confidence that the future, as far as can be anticipated, holds nothing to worry about.

# Metal Market Review

Written for The Metal Industry by R. J. HOUSTON, of D. Houston & Company, Inc., Metal Brokers, New York

NOVEMBER 1, 1926

## COPPER

Price changes in the market for copper were narrow lately and for the most part the trading was quiet. During the first half of the month, however, substantial sales were made at about 14⅛c for Connecticut delivery for shipment over balance of the year. Interest in the market was a comparatively small affair much of the time, but consumers appeared to be watching developments. The price tendency was easy, but lower quotations have not as yet materially improved new demand. The decline carried the price down to 14 cents, and this represents a loss of ¼ cent per pound since October 1.

The slight downturn is looked upon as merely a temporary market incident. Fundamental conditions do not point to any important recession in prices. With the Copper Exporters, Inc., in actual operation, the situation is expected to reflect the steadying influence of this gigantic organization. A likelihood of a firmer price trend is reasonably certain in the course of time, but best judges of the situation are not expecting any excessive advance in the price of copper either in the domestic or foreign markets.

Foreign and domestic shipments of copper in September amounted to 239,822,000 pounds compared with 254,414,000 pounds in August, a decrease of 14,592,000 pounds. Production of refined copper during September was 246,780,000 pounds. Surplus stocks of refined copper amounted to 140,274,000 pounds October 1, compared with 133,316,000 pounds September 1 and 129,980,000 pounds August 1.

## ZINC

The market for zinc yielded fully an ⅛ cent per pound during October, but the softening process was more or less gradual and on recessions fair sized orders were booked. Prime Western zinc quotes 7.25c St. Louis basis and 7.60c New York. There was some demand for brass special at a slight premium over prime Western grade. Consumption holds up in good volume as is seen by September deliveries of 54,609 tons, against an output for the month of 52,144 tons. There was a further decrease in stocks held by smelters of 2,465 tons during September. Zinc stocks on October 1 amounted to 15,699 tons and were the smallest since February 1 when they stood at 14,300 tons. On June 1 stocks were 29,934 tons. Some large sales were made at the end of October at 7.25c East St. Louis basis for November shipment.

## TIN

Wide price fluctuations and alternate exhibitions of strength and weakness were frequent and conspicuous features of the tin situation during the past month. Stability in this commodity does not exist. Speculation in the metal is encouraged and carried on with feverish activity, and the whole situation is dominated largely by the vigorous movements of important operators at London and New York.

Consumers, however, usually play a very conservative role and must accept, to a considerable extent, the results of speculative operations. There is a thoroughly sound foundation for the present remarkable strength of the tin situation. Domestic requirements have been on an expanding scale for the last two years, and with the world's consumption in excess of production the upward movement is easily accounted for. But prices have soared to a high pitch, and market movements are likely to be highly irregular and extremely sensitive. October business was large at various levels. The high point was 71¾c for prompt Straits and 71½c for first half of October. The peak of the market was on October 15th and on that date there was a spread of 3c to 3¼c between spot Straits and January delivery, the future position being available at the lower prices. It is difficult to avoid the conclusion that high prices for tin are inevitable for a long time to come owing to the strong statistical position of the article. Market was easy November 1st at 67⅞c bid for spot Straits, November delivery quoted 66½c @ 67c.

## LEAD

The lead market here declined from 8.65c to 8.25c New York basis during October. There were substantial sales for both prompt and future deliveries. At the lower figures there appeared to be signs of fair stability, although the irregular course of the London market and weaker tone there had its influence in local circles. Consumption continues large and there are many requirements to cover over the next two to three months. The St. Louis price quotes 8 cents, with some speculative holdings reported at a shade below this figure. Present price compares with a high 10¾c last year and a high this year of 9.20c St. Louis basis. Supplies of prompt metal are understood to be adequate but there are no indications that stocks are specially heavy. On November 1 there was a sharp decline in the London market and on same date the American Smelting & Refining Co. reduced the price 15 points to 8.10c New York basis.

### ALUMINUM

The price situation remains firm and consumption is good in some industries, with perhaps some slowing down in the automotive industry. There is an idea that the larger facilities for production will eventually mean lower prices in order to stimulate a larger demand. Consumers have been inclined to defer purchases lately to see what developments may transpire in the last quarter of year. English makers have lower prices lately, but recent quotations were too high for this market with duty added. Talk of a new aluminum cartel in Europe has not revealed anything definite as yet. Virgin grade No. 12 quotes 26.50c and 99% plus 27c.

### ANTIMONY

There was a firm and active market during the first half of October and sales were made for nearby arrival at 13⅛c@13⅝c duty paid. On indications of a hardening tendency business was also done at 13¾c and at 14c for future positions. Dealers and consumers were buyers on the firmer developments. Further interest was displayed by buyers later in the month and active trading took place on basis of the equivalent of 14½c duty paid for October-November shipment from China. The market developed an easier tone at the end of month and buyers were rather indifferent to the lower offers. Stocks here are not heavy, but there is a fairly large tonnage afloat. Prompt delivery of regulars quotes 13⅜c duty paid.

### QUICKSILVER

The market for quicksilver is strong at $98 to $99 per flask. Consumers were good buyers, and manufacturers have the situation in control. Stocks were down to narrow limits and the position is regarded as very strong.

### PLATINUM

Refined platinum quotes $107 to $110 per ounce. Larger supplies were available and prices gave way as quoted. Russian production during the current year is expected to reach something like 100,000 to 110,000 ozs., whereas in 1925 it probably did not exceed 70,000 to 80,000 ozs. A shipment of 20,334 ozs. of refined platinum arrived in London from Russia in the first half of October.

### SILVER

A series of market slumps marked the developments in silver last month. The downward tendency was most pronounced due to heavy selling for Chinese account and the prospect of a change in the monetary system of India. The reaction to the realization that this important movement will work a great ultimate change in Far Eastern conditions is reflected in the drastic decline recorded for the white metal. The New York market dropped to 51⅞c last month. There has been an advance since, but with irregular features. On November 1 the official quotation was 53⅜c. India was a recent buyer to some extent. China and India are liable to play both sides of the market from time to time. India, now a large gold accumulator, is more likely to market than hoard silver in the future. International financiers and statesmen have appraised the importance of the situation, and producers and consumers are watching developments with keen interest.

### OLD METALS

Conditions in the scrap metal market is somewhat easier and unsettled for the copper and lead scraps owing to the downward tendency for the new metals. There is a fair movement going on between sellers and buyers, however, but much of it is on a hand-to-mouth basis. The brass grades appear to find ready buyers, but the lead grades have been specially quiet. Consumers are reluctant buyers and dealers are not interested except at concessions. Prices dealers are willing to pay at end of month were quoted at 11½c for heavy copper, 9½c@9¾c for light copper, 7c@7¼c for heavy brass, 6¼c for light brass, 6½c@6¾c for heavy lead, new brass clippings 9½c, old zinc 4c@4¼c, and aluminum clippings 21c@21½c.

## WATERBURY AVERAGE

Lake Copper—Average for 1925, 14.427—January, 1926 14.25c. —February, 14⅜c.—March, 14.25c.—April, 14.125c.—May, 14.00c. —June, 14.00c.—July, 14.25c.—August, 14.50c.—September, 14.50c. —October, 14.25c.

Brass Mill Zinc—Average for 1925, 8.263—January, 1926, 9.00c. —February, 8.20c.—March, 7.80c.—April, 7.45c.—May, 7.20c.—June, 7.55c.—July, 7.80c.—August, 7.80c.—September, 7.85c.—October, 7.70c.

# Daily Metal Prices for the Month of October, 1926

## Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

| | 1 | 4 | 5 | 6 | 7 | 8 | 11 | †12 | 13 | 14 | 15 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Copper** (f. o. b. Ref.) c/lb. Duty Free | | | | | | | | | | | | |
| Lake (Delivered) | 14.375 | 14.375 | 14.375 | 14.375 | 14.25 | 14.25 | 14.25 | ...... | 14.25 | 14.35 | 14.35 | 14.25 |
| Electrolytic | 14.15 | 14.15 | 14.15 | 14.10 | 14.05 | 14.05 | 14.05 | ...... | 14.10 | 14.10 | 14.20 | 14.15 |
| Casting | 13.80 | 13.80 | 13.80 | 13.75 | 13.70 | 13.70 | 13.70 | ...... | 13.70 | 13.85 | 13.85 | 13.85 |
| **Zinc** (f. o. b. St. L.) c/lb. Duty 1¾c/lb. | | | | | | | | | | | | |
| Prime Western | 7.375 | 7.35 | 7.35 | 7.325 | 7.325 | 7.325 | 7.30 | ...... | 7.325 | 7.35 | 7.375 | 7.375 |
| Brass Special | 7.425 | 7.40 | 7.40 | 7.40 | 7.375 | 7.375 | 7.40 | ...... | 7.375 | 7.40 | 7.425 | 7.425 |
| **Tin** (f. o. b., N. Y.) c/lb. Duty Free | | | | | | | | | | | | |
| Straits | 71.00 | 71.625 | 71.125 | 71.75 | 71.50 | 71 | 70.625 | ...... | 70.00 | 71.50 | 71.75 | 70.50 |
| Pig 99% | 68.50 | 69.25 | 69 | 69.50 | 69.50 | 69 | 68.625 | ...... | 68.25 | 69.75 | 70.00 | 69.00 |
| **Lead** (f. o. b. St. L.) c/lb. Duty 2⅛c/lb. | 8.35 | 8.35 | 8.35 | 8.25 | 8.25 | 8.25 | 8.20 | ...... | 8.15 | 8.15 | 8.15 | 8.15 |
| **Aluminum** c/lb. Duty 5c/lb. | 27 | 27 | 27 | 27 | 27 | 27 | 27 | ...... | 27 | 27 | 27 | 27 |
| **Nickel** c/lb. Duty 3c/lb. | | | | | | | | | | | | |
| Ingot | 35 | 35 | 35 | 35 | 35 | 35 | 35 | ...... | 35 | 35 | 35 | 35 |
| Shot | 36 | 36 | 36 | 36 | 36 | 36 | 36 | ...... | 36 | 36 | 36 | 36 |
| Electrolytic | 39 | 39 | 39 | 39 | 39 | 39 | 39 | ...... | 39 | 39 | 39 | 39 |
| **Antimony** (J. & Ch.) c/lb. Duty 2c/lb. | 14.00 | 13.75 | 13.75 | 13.625 | 13.625 | 14.50 | 14.25 | ...... | 14.25 | 14.25 | 14.50 | 14.25 |
| **Silver** c/oz. Troy Duty Free | 57.125 | 58.375 | 56.875 | 56.25 | 56.125 | 55.75 | 56.375 | ...... | 56.125 | 55.25 | 54.00 | 52 |
| **Platinum** $/oz. Troy Duty Free | 115 | 110 | 110 | 110 | 110 | 110 | 110 | ...... | 110 | 110 | 110 | 110 |

| | 19 | 20 | 21 | 22 | 25 | 26 | 27 | 28 | 29 | High | Low | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Copper** (f. o. b. Ref.) c/lb. Duty Free | | | | | | | | | | | | |
| Lake (Delivered) | 14.25 | 14.25 | 14.25 | 14.25 | 14.25 | 14.25 | 14.25 | 14.125 | 14.125 | 14.375 | 14.125 | 14.273 |
| Electrolytic | 14.125 | 14.10 | 14.10 | 14.10 | 14.10 | 14.10 | 14.10 | 14.05 | 14.025 | 14.20 | 14.025 | 14.103 |
| Casting | 13.85 | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 | 13.75 | 13.70 | 13.65 | 13.85 | 13.65 | 13.773 |
| **Zinc** (f. o. b. St. L.) c/lb. Duty 1¾c/lb. | | | | | | | | | | | | |
| Prime Western | 7.35 | 7.325 | 7.30 | 7.30 | 7.275 | 7.25 | 7.25 | 7.25 | 7.25 | 7.375 | 7.25 | 7.316 |
| Brass Special | 7.40 | 7.375 | 7.35 | 7.35 | 7.35 | 7.325 | 7.30 | 7.275 | 7.30 | 7.425 | 7.275 | 7.371 |
| **Tin** (f. o. b., N. Y.) c/lb. Duty Free | | | | | | | | | | | | |
| Straits | 70.50 | 69.25 | 69.25 | 69.625 | 69.50 | 69.00 | 69.50 | 69 | 68.25 | 71.75 | 68.25 | 70.313 |
| Pig 99% | 69.00 | 67.75 | 68.00 | *.... | *.... | *.... | *.... | *.... | *.... | 70.00 | 67.75 | 68.938 |
| **Lead** (f. o. b. St. L.) c/lb. Duty 2⅛c/lb. | 8.125 | 8.075 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.35 | 8.00 | 8.14 |
| **Aluminum** c/lb. Duty 5c/lb. | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| **Nickel** c/lb. Duty 3c/lb. | | | | | | | | | | | | |
| Ingot | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| Shot | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| Electrolytic | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| **Antimony** (J. & Ch.) c/lb. Duty 2c/lb. | 14.25 | 14.25 | 14.25 | 14.25 | 14.25 | 14.00 | 13.75 | 13.50 | 13.375 | 14.50 | 13.375 | 14.031 |
| **Silver** c/oz. Troy Duty Free | 51.50 | 51.875 | 54.125 | 51.875 | 52.875 | 53.25 | 53.75 | 52.75 | 53 | 58.375 | 51.50 | 54.463 |
| **Platinum** $/oz. Troy Duty Free | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 115 | 110 | 110.25 |

* Not quoted. † Holiday

# Metal Prices, November 8, 1926

## NEW METALS

**Copper:** Lake, 14.125. Electrolytic, 13.95. Casting, 13.55.
**Zinc:** Prime Western, 7.175. Brass Special, 7.225.
**Tin:** Straits, 70.00. Pig, 99%, 68.00.
**Lead:** 7.80. **Aluminum,** 27.00. **Antimony,** 13.00.
**Nickel:** Ingot, 35. Shot, 36. Elec., 39. Pellets, 40.
**Quicksilver:** flask, 75 lbs., $99.00. **Bismuth,** $2.70 to $2.75.
**Cadmium,** 60. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 53.50.
**Gold,** oz., Troy, $20.67. **Platinum,** oz., Troy, $110.00.

## INGOT METALS AND ALLOYS

| | |
|---|---|
| Brass Ingots, Yellow | 10½ to 11½ |
| Brass Ingots, Red | 12 to 13 |
| Bronze Ingots | 12 to 13 |
| Casting Aluminum Alloys | 21 to 24 |
| Manganese Bronze Castings | 24 to 42 |
| Manganese Bronze Ingots | 13½ to 17 |
| Manganese Bronze Forging | 34 to 42 |
| Manganese Copper, 30% | 25 to 35 |
| Monel Metal Shot | 32 |
| Monel Metal Blocks | 32 |
| Parsons Manganese Bronze Ingots | 18¼ to 19¾ |
| Phosphor Bronze | 13½ to 15 |
| Phosphor Copper, guaranteed 15% | 18⅞ to 22½ |
| Phosphor Copper, guaranteed 10% | 18 to 21½ |
| Phosphor Tin, guaranteed 5% | 70 to 80 |
| Phosphor Tin, no guarantee | 70 to 80 |
| Silicon Copper, 10%....according to quantity | 30 to 36 |

## OLD METALS

| Buying Prices | | Selling Prices |
|---|---|---|
| 11¾ to 12¼ | Heavy Cut Copper | 13¼ to 13¾ |
| 11½ to 12 | Copper Wire | 13 to 13¼ |
| 10¼ to 10¾ | Light Copper | 11½ to 11¾ |
| 9¼ to 9½ | Heavy Machine Composition | 10¾ to 11 |
| 7¾ to 8 | Heavy Brass | 9 to 9¼ |
| 6¾ to 7 | Light Brass | 8 to 8¼ |
| 7¾ to 8¼ | No. 1 Yellow Brass Turnings | 9½ to 10 |
| 8¾ to 9¼ | No. 1 Composition Turnings | 10½ to 11 |
| 7½ to 7¾ | Heavy Lead | 8¼ to 8½ |
| 5 to 5¼ | Zinc Scrap | 6 to 6½ |
| 12 to 13 | Scrap Aluminum Turnings | 15 to 17 |
| 16½ to 18 | Scrap Aluminum, cast alloyed | 20 to 21 |
| 22½ to 23 | Scrap Aluminum, sheet (new) | 24 to 25½ |
| 38 to 40 | No. 1 Pewter | 42 to 44 |
| 12 | Old Nickel Anodes | 14 |
| 18 | Old Nickel | 20 |

# Wrought Metals and Alloys

## COPPER SHEET

| | |
|---|---|
| Mill shipments (hot rolled) | 21½c. to 22½c. net base |
| From stock | 22½c. to 23½c. net base |

## BARE COPPER WIRE

16¼c. to 16⅜c. net base, in carload lots.

## COPPER SEAMLESS TUBING

24½c to 25½c. net base.

## SOLDERING COPPERS

| | |
|---|---|
| 300 lbs. and over in one order | 21 c. net base |
| 100 lbs. to 200 lbs. in one order | 21½c. net base |

## ZINC SHEET

| | |
|---|---|
| Duty, sheet, 15% | Cents per lb. |
| Carload lots, standard sizes and gauges, at mill, less 8 per cent discount | 11.75 net base |
| Casks, jobbers' price | 13.00 net base |
| Open Casks, jobbers' price | 13.50 to 13.75 net base |

## ALUMINUM SHEET AND COIL

| | |
|---|---|
| Aluminum sheet, 18 ga., base price | 39c. |
| Aluminum coils, 24 ga., base price | 35.7c. |
| Foreign | 40c. |

## ROLLED NICKEL SHEET AND ROD

Net Base Prices

| | | | |
|---|---|---|---|
| Cold Drawn Rods | 53c. | Cold Rolled Sheet | 60c. |
| Hot Rolled Rods | 45c. | Hot Rolled Sheet | 52c. |

## BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c or over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

## SILVER SHEET

Rolled sterling silver, 54½ to 56½c.

## BRASS MATERIAL—MILL SHIPMENTS

In effect October 27, 1926
To customers who buy 5,000 lbs. or more in one order.

| | Net base per lb. | | |
|---|---|---|---|
| | High Brass | Low Brass | Bronze |
| Sheet | $0.18⅞ | $0.20⅜ | $0.22⅜ |
| Wire | .19⅜ | .20⅞ | .22⅞ |
| Rod | .16⅝ | .21⅛ | .23⅛ |
| Brazed tubing | .26⅞ | ...... | .32⅛ |
| Open seam tubing | .26⅞ | ...... | .32⅛ |
| Angles and channels | .29⅞ | ...... | .35⅛ |

For less than 5,000 lbs. add 1c. per lb. to above prices.

## BRASS SEAMLESS TUBING

23¾c. to 24¾c. net base.

## TOBIN BRONZE AND MUNTZ METAL

| | |
|---|---|
| Tobin Bronze Rod | 20⅞c. net base |
| Muntz or Yellow Metal Sheathing (14"x48") | 18⅞c. net base |
| Muntz or Yellow Rectangular sheet other Sheathing | 19⅞c. net base |
| Muntz or Yellow Metal Rod | 16⅞c. net base |

Above are for 100 lbs. or more in one order.

## NICKEL SILVER (NICKELENE)

Net Base Prices

| Grade "A" Sheet Metal | | Wire and Rod | |
|---|---|---|---|
| 10% Quality | 26¾c. | 10% Quality | 29¾c. |
| 15% " | 28¼c. | 15% " | 33½c. |
| 18% " | 29½c. | 18% " | 36¾c. |

## MONEL METAL SHEET AND ROD

| | | | |
|---|---|---|---|
| Hot Rolled Rods (base) | 35 | Hot Rolled Sheets (base) | 42 |
| Cold Drawn Rods (base) | 43 | Cold Rolled Sheets (base) | 50 |

## BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

# Supply Prices, November 8, 1926

## ANODES

| | | |
|---|---|---|
| Copper: | Cast | 21⅛c. per lb. |
| | Rolled | 19⅜c. per lb. |
| | Electrolytic | 18⅜c. per lb. |
| Brass: | Cast | 20⅛c. per lb. |
| | Rolled | 20⅞c. per lb. |
| Zinc: | Cast | 14¼c. per lb. |

| | | |
|---|---|---|
| Nickel: | 90-92% | 45c. per lb. |
| | 95-97% | 47c. per lb. |
| | 99% | 49c. per lb. |

**Silver:** Rolled silver anodes .999 fine are quoted from 56c. to 58c. per Troy ounce, depending upon quantity purchased.

## FELT POLISHING WHEELS WHITE SPANISH

| Diameter | Thickness | Under 100 lbs. | 100 to 200 lbs. | Over 200 lbs. |
|---|---|---|---|---|
| 10-12-14 & 16" | 1" to 3" | $3.00/lb. | $2.75/lb. | $2.65/lb. |
| 6-8 & over 16 | 1 to 3 | 3.10 | 2.85 | 2.75 |
| 6 to 24 | Under ½ | 4.25 | 4.00 | 3.90 |
| 6 to 24 | ½ to 1 | 4.00 | 3.75 | 3.65 |
| 6 to 24 | Over 3 | 3.40 | 3.15 | 3.05 |
| 4 up to 6 | ¼ to 3 | 4.85 | 4.85 | 4.85 |
| 4 up to 6 | Over 3 | 5.25 | 5.25 | 5.25 |
| Under 4 | ¼ to 3 | 5.45 | 5.45 | 5.45 |
| Under 4 | Over 3 | 5.85 | 5.85 | 5.85 |

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

## COTTON BUFFS

Full Disc Open buffs, per 100 sections.

| | |
|---|---|
| 12" 20 ply 64/68 Unbleached | $28.85-29.00 |
| 14" 20 ply 64/68 Unbleached | 35.90-37.30 |
| 12" 20 ply 80/92 Unbleached | 30.10 |
| 14" 20 ply 80/92 Unbleached | 40.80 |
| 12" 20 ply 84/92 Unbleached | 34.80-42.85 |
| 14" 20 ply 84/92 Unbleached | 47.20-57.40 |
| 12" 20 ply 80/84 Unbleached | 37.75-38.90 |
| 14" 20 ply 80/84 Unbleached | 51.20-52.40 |

Sewed Pieced Buffs, per lb., bleached 65-75c.

## CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

| | | |
|---|---|---|
| Acetone | lb. | .12-.16 |
| Acid—Boric (Boracic) Crystals | lb. | .12 |
| Hydrochloric (Muriatic) Tech., 20°, Carboys | lb. | .02 |
| Hydrochloric, C. P., 20 deg., carboys | lb. | .06 |
| Hydrofluoric, 30%, bbls | lb. | .08 |
| Nitric, 36 deg., carboys | lb. | .06 |
| Nitric, 42 deg., carboys | lb. | .07 |
| Sulphuric, 66 deg., carboys | lb. | .02 |
| Alcohol—Butyl | lb. | .19-23½ |
| Denatured, bbls. | gal. | .46 |
| Alum—Lump, Barrels | lb. | .03¼ |
| Powdered, Barrels | lb. | .042 |
| Aluminum sulphate, commercial tech | lb. | .02⅜ |
| Aluminum chloride solution in carboys | lb. | .06½ |
| Ammonium—Sulphate, tech. bbls | lb. | .03¾ |
| Sulphocyanide | lb. | .65 |
| Arsenic, white, kegs | lb. | .05 |
| Asphaltum | lb. | .35 |
| Benzol, pure | gal. | .60 |
| Borax Crystals (Sodium Biborate), bbls | lb. | .05½ |
| Calcium Carbonate (Precipitated Chalk) | lb. | .04 |
| Carbon Bisulphide, Drums | lb. | .06 |
| Chrome Green, bbls | lb. | .29 |
| Copper—Acetate (Verdegris) | lb. | .37 |
| Carbonate, bbls | lb. | .17 |
| Cyanide (100 lb. kegs) | lb. | .50 |
| Sulphate, bbls. | lb. | .05½ |
| Cream of Tartar Crystals (Potassium bitartrate) | lb. | .27 |
| Crocus | lb. | .15 |
| Dextrin | lb. | .05-.08 |
| Emery Flour | lb. | .06 |
| Flint, powdered | ton | $30.00 |
| Fluor-spar (Calcic fluoride) | ton | $75.00 |
| Fusel Oil | gal. | $4.45 |
| Gold Chloride | oz. | $14.00 |
| Gum—Sandarac | lb. | .26 |
| Shellac | lb. | .59-.61 |
| Iron, Sulphate (Copperas), bbl | lb. | .01½ |
| Lead Acetate (Sugar of Lead) | lb. | .13¾ |
| Yellow Oxide (Litharge) | lb. | .12½ |
| Mercury Bichloride (Corrosive Sublimate) | lb. | $1.21 |
| Nickel—Carbonate dry, bbls | lb. | .29 |
| Chloride, bbls. | lb. | .18-.21 |
| Salts, single 300 lb. bbls | lb. | .10½ |
| Salts, double 425 lb. bbls | lb. | .10 |
| Paraffin | lb. | .05-.06 |
| Phosphorus—Duty free, according to quantity | | .35-.40 |
| Potash, Caustic Electrolytic 88-92% broken, drums | lb. | .09¼ |
| Potassium Bichromate, casks (crystals) | lb. | .08½ |
| Carbonate, 96-98% | lb. | .07 |
| Cyanide, 165 lb. cases, 94-96% | lb. | .57½ |
| Pumice, ground, bbls | lb. | .02½ |
| Quartz, powdered | ton | $30.00 |
| Rosin, bbls. | lb. | .04½ |
| Rouge, nickel, 100 lb. lots | lb. | .25 |
| Silver and Gold | lb | .65 |
| Sal Ammoniac (Ammonium Chloride) in casks | lb. | .06 |
| Silver Chloride, dry | oz. | .86 |
| Cyanide (fluctuating) | oz. | .57½ |
| Nitrate, 100 ounce lots | oz. | .38¾ |
| Soda Ash, 58%, bbls | lb. | .02½ |
| Sodium—Cyanide, 96 to 98%, 100 lbs | lb. | .20 |
| Hyposulphite, kegs | lb. | .04 |
| Nitrate, tech., bbls | lb. | .04¾ |
| Phosphate, tech., bbls | lb. | .03¾ |
| Silicate (Water Glass), bbls | lb. | .02 |
| Sulpho Cyanide | lb. | .45 |
| Sulphur (Brimstone), bbls | lb. | .02 |
| Tin Chloride, 100 lb. kegs | lb. | .48½ |
| Tripoli, Powdered | lb. | .03 |
| Wax—Bees, white ref. bleached | lb. | .60 |
| Yellow, No. 1 | lb. | .45 |
| Whiting, Bolted | lb. | .02½-.06 |
| Zinc, Carbonate, bbls | lb. | .11-.12 |
| Chloride, casks | lb. | .06¼ |
| Cyanide (100 lb. kegs) | lb. | .41 |
| Sulphate, bbls. | lb. | .03½ |